McGraw-Hill Publishing Company, Inc. AUGUST, 1939 Price 35c. per copy

AVIATION

The Oldest American Aeronautical Magazine

MORE WASPS *for the Army*

As the United States Army celebrates the 30th anniversary of its flying service, squadron after squadron of new airplanes are joining the Air Corps. Among these are a large number of Basic Combat airplanes developed by North American Aviation. Like every one of the BC-1's already serving the Army, these new BC-1A's are powered by dependable Pratt & Whitney Wasp engines.

PRATT & WHITNEY AIRCRAFT
One of the three divisions of
UNITED AIRCRAFT CORPORATION
EAST HARTFORD, CONNECTICUT

Perhaps there is no niche in the Hall of Fame for a gasoline, and no laurel wreath to fit an oil. But with every new triumph of aviation, Shell engineers and scientists find a deep satisfaction in knowing that their efforts have helped somewhat to bring new glories to a great American industry.

SHELL

AVIATION PRODUCTS

Picked Up Along Editorial Airways

» **AGAIN, RESEARCH** claims attention of Congressional committees. Dr. George Lewis returned from Europe this month with a whole new set of observations fully confirming reports of Germany's superiority in the field of aeronautical research. It is very disconcerting, if not downright alarming, to find ourselves trailing European research by a wide margin, especially since our own NACA served so long as the model to be followed by other countries, including Germany. Dr. Lewis and Col. Lindbergh have been making valiant efforts to get the facts before the appropriations committees to bolster up our lagging research programs. It is to be earnestly hoped that the gentlemen of the present Congress will immediately release the necessary funds to go ahead with the new laboratories at Sunnyvale, and to support an extensive schedule of aeronautical research projects in those universities which already have the equipment installed to carry on such work. If we are ever to regain our technical lead in aviation we must expand our research facilities at at least an equal rate with our productive capacity. That seems only common sense.

» **PHILADELPHIA STORY**-of-the-month is the successful demonstration and the subsequent starting of handling mails between Camden Airport and the Philadelphia Post Office by autogiro. (Story on page 69.) We have always maintained that there were specialized fields in which the potentialities of the autogiro were great, and this seems to be one of them. We shall watch the continuation of the experiment with considerable interest. Captain Rickenbacker and Eastern Airlines are to be congratulated on their sponsorship of the idea.

ALHAMBRA MEETING. The day we dropped in for a visit with Harlow at his Alhambra factory, we found a couple of old friends there, too,—Jack O'Meara, down from Michigan, and Howard Allor, out from Roosevelt Field. Both are now distributors for Harlow. Shortly after, we had a ride in the "Private Transport" with Jack Kelly, Harlow Sales Manager.

» **A WESTERN CRUISE** is a good idea for anyone, but an especially good idea for anyone in aviation these days, for out there things are certainly booming along in a big way. All factories are full of orders, both for domestic and export purposes, and all of them are clearing the decks and building up their organizations to take care of the orders which will shortly be coming out of Washington for our Air Force re-building program.

» **AFTER SITTING IN** at the mid-summer Maintenance Meeting (6/12 to 6/14), we spent the rest of the week going the rounds of plants in the Los Angeles and San Diego areas. We would like to take the opportunity here to thank all those at Douglas, Lockheed, North American, Consolidated, Ryan, and Solar for the courtesies extended to Charlie McReynolds and your editor during that time. We hope to see you all in the east before too long. How about coming over to see our Fair?

» **AND SPEAKING OF FAIRS,** Tom Morgan and his associates are to be congratulated for the job that they have done in presenting aviation to the public at the New York Fair. The time for putting the exposition together was short and there were many difficulties in the way, but the committee succeeded in creating a degree of cooperation in the industry that was noteworthy. It is only to be regretted that more actual flying could not have been arranged for fair visitors, but possibly when North Beach airport is completed that situation will be greatly improved.

» **A TURNING POINT** in air transport history is marked by the early summer of 1939. At long last, after

ASK THE PILOTS"
BG
NC18838
The T8P1
TRANSPORT
[8-10 PLACE]
Especially designed for
small field operations
TRANSPORT • BUSINESS CRUISER • AIRAMBULANCE • FEEDERPLANE • EXPLORER • FREIGHTER
BOMBER • CHARTER PLANE • STAFF TRANSPORT • PHOTOGRAPHIC PLANE • INTERMEDIATE TRANSPORT
THE BARKLEY-GROW AIRCRAFT CORPORATION. DETROIT. MICH.. U.S.A.

TRANSPORT • BUSINESS CRUISER • ATTACK BOMBER • CHARTER PLANE • STAFF TRANSPORT • PHOTOGRAPHIC PLANE • INTERMEDIATE TRANSPORT
THE BARKLEY-GROW AIRCRAFT CORPORATION, DETROIT, MICH., U.S.A.

years of development, of trial and of hard-won experience, the North Atlantic is being crossed by regularly scheduled air service for passengers and cargo. In the March issue of AVIATION we set up the background against which Pan American is now sending its Clippers back and forth between Europe and America. Here we wish only to mark the opening of that service, and to wish them Godspeed as they embark on the final stages of another high adventure for American wings, the commercial conquest of the last barrier, the North Atlantic.

» **AN ORCHID ALSO** to that other organization which is now preparing to fly the same routes, American Export Air Lines. Elsewhere in the issue will be found the news story of their first survey flights with the flying boat "Trans-Atlantic". With many years of steamship operation behind it, American Export brings to the Atlantic air picture a type of experience that should serve them in good stead. To them, also, the best of luck.

» **ATTENTION, LADIES!** If you are one of those unhappy females whose husbands indulge in frequent and prolonged absences from home (presumably on business), you are eligible to join Jerry Lederer's new club—*La Ligue de Femmes des Hommes en Aviation, Quelles Domages!* (Which, being freely translated, means "League for the Wives of Men in Aviation, Poor Things!) Only requirement is that your husband must be away from home (allegedly engaged in aeronautical business) for at least one month of the year. Why not organize a "Rookery" in your town? Why not get yourself elected an official "Keeper of the Nest Egg"? For full details, write Jerome Lederer at 260 Riverside Drive, New York.

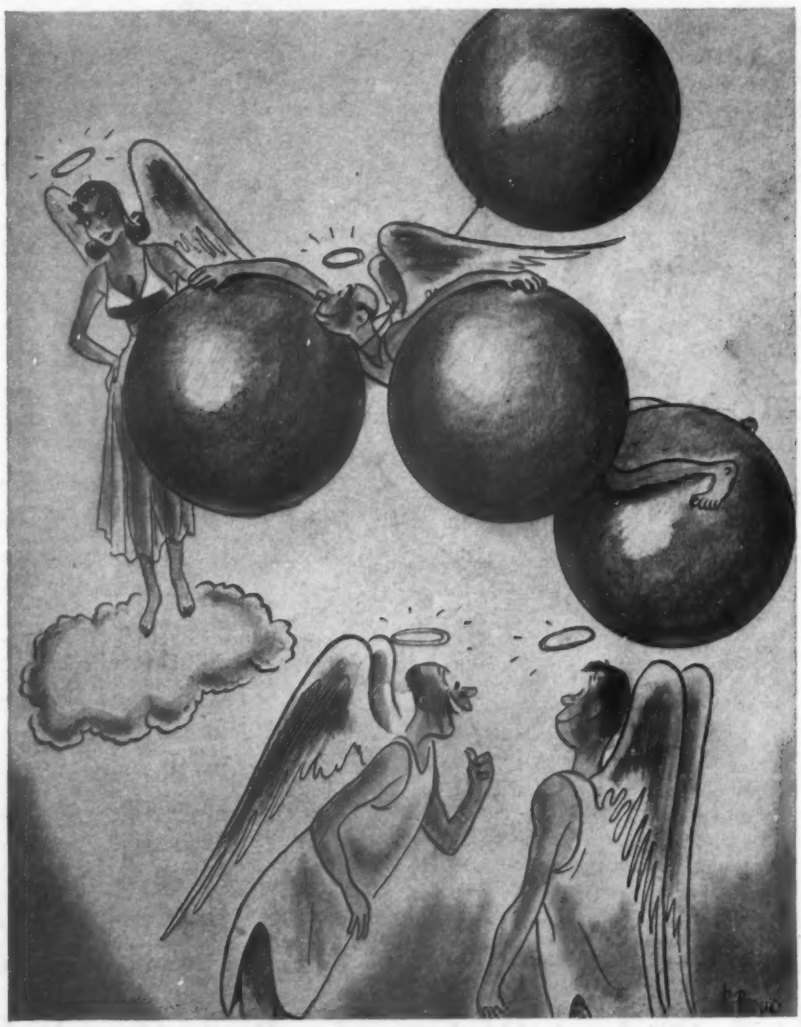
» **BIRTHDAYS** seem to be cropping up thick and fast this month. The Army Air Corps celebrates its 30th (page 18), Donald Douglas and Walter Beech join the ranks of the real old timers with 25 years of activity in aviation, and TWA marks the end of its first decade of operations on its transcontinental route.

» **TESTIMONIALS WERE TENDERED** to Walter Beech at a dinner given July 11th in Wichita's Allis Hotel by Wichita's Chamber of Commerce to mark the 25th anniversary of his first airplane flight. Many may claim the distinction of first flights as long ago as that, but not many can match Beech's record for continuous participation in and contribution to the aviation industry.

» **DONALD DOUGLAS** began his second twenty-five years of service to the industry in mid-June. Many tough years, and a long, hard pull lay between the unfledged graduate of M.I.T. of the Class of 1914 and the top job of the largest aircraft manufacturing organization in the country. Douglas has left his mark on military and commercial aviation all over the world, from the time of the Round-the-World flight of 1924, down to the current Army bombers and DC series transports.

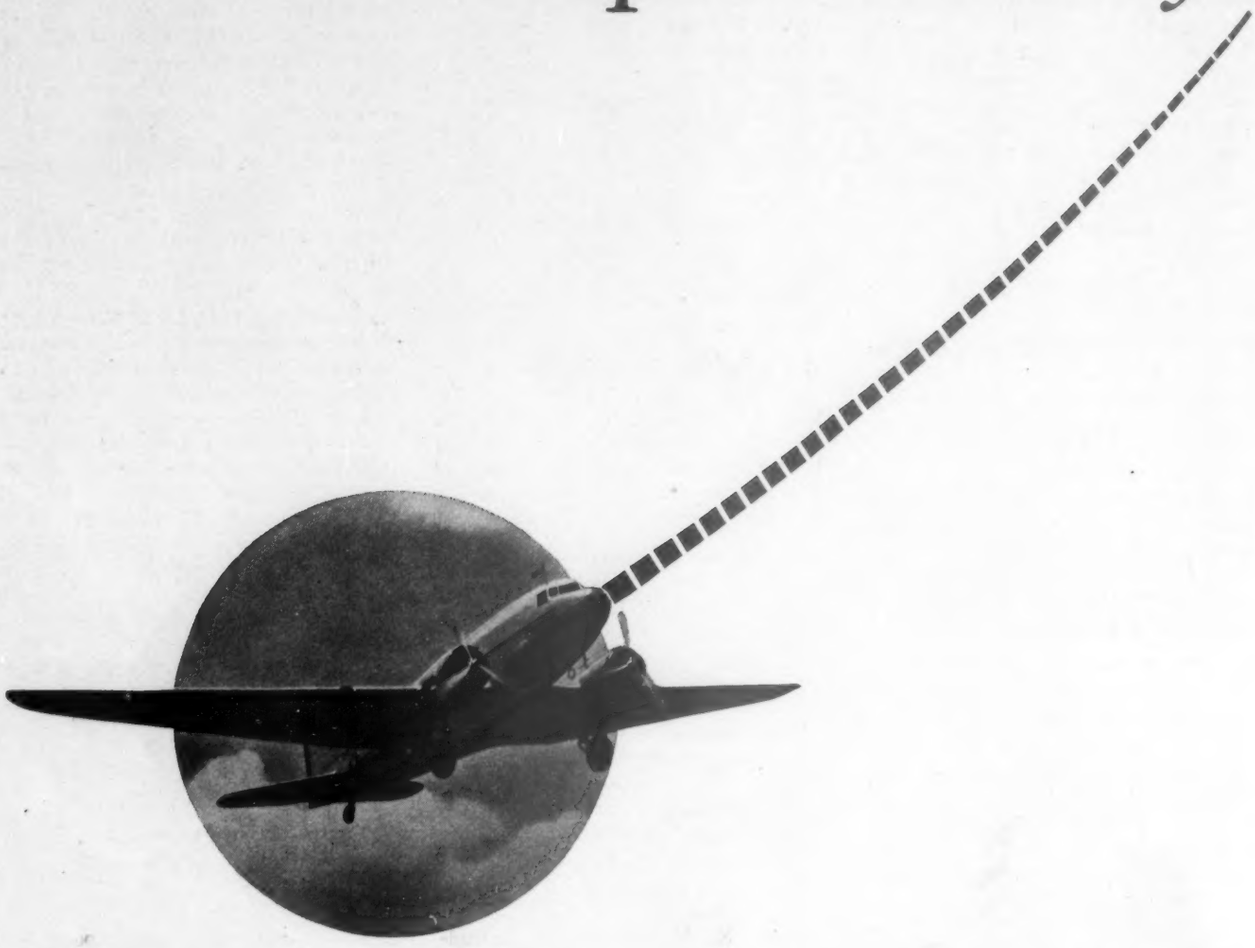
» **TEN FOR TWA** becomes a fact this month as Transcontinental & Western Air completes its first decade. Pioneered by a far-seeing group that believed it feasible to link East and West Coasts by overnight or one-day services, the years have seen these hopes become reality. In 1929, the predecessor company, TAT (Transcontinental Air Transport) began a combination air-rail service. That year it carried 14,600 passengers in Ford Tri-motors (remember them?) over 2,627 miles of route, making the NY-LA trip in some 48 hours and 5 minutes. Today, its Douglas transports whisk its customers cross-country in 15 hours and 14 minutes. This year an estimated quarter-million people will travel over its 5,000 miles of line. Progress, or something!

» **CONGRATULATIONS ALL!** While in this festive mood AVIATION is tempted to whip up a cake and to stud it with candles,—thirty for the Army, twenty-five each for Donald and Walter, half a score for TWA,—and any number extra for any of the rest of our good friends who happen to come aboard with a birthday.



"Maguire's been out collecting sounding balloons for her bubble dance at the Paradise Club!"

Up . . . *smoothly!*



the easy take-off that builds flying confidence!

Because you start and end each flight with ground-contact, your landing gear has a doubled responsibility. And because this problem is our prime concern, Bendix gives it the concentrated, serious study it deserves. The result is a combination of highly efficient shock-absorption and smooth, easy steering and positive stopping.

Military and commercial flying needs this protection to costly investment and precious lives. To serve best, it should be designed into the airplane at the time the under-carriage is being determined.

Bendix Pneudraulic Shock Struts, Tail Knuckle Assemblies and Airplane Wheels and Brakes are contributing appreciably to the maneuverability and confidence-inspiring ground-performance of a high percentage of the finest aircraft.

Bendix

BENDIX PRODUCTS DIVISION
of Bendix Aviation Corporation, South Bend, Indiana

LANDING-GEAR EQUIPMENT

AIRPLANE WHEELS, BRAKES, PNEUDRAULIC
SHOCK STRUTS, TAIL KNUCKLE ASSEMBLIES

Side Slips

By
ROBERT OSBORN

» AT THE MOMENT of going to press the Far Eastern situation seems to include air fights over an extended length of border between Soviet-Mongol airplanes and Japanese-Manchukuo airplanes. According to dispatches from Moscow about 120 enemy planes are brought down each day with the loss of only three of their own—with exactly opposite reports coming from Tokio.

As we should like to keep up on aeronautical affairs throughout the world, even when they involve the unfortunate situation of an undeclared war, we wish some research organization would determine the proper percentages to use when reading these dispatches.

» Now that Mr. Richard Archbold has returned from his flying boat exploration tour of the South Sea Islands we shall be very much interested in hearing if he discovered just one island which hadn't been fortified. If perchance he did find one we'd appreciate it very much if he'd whisper its location to us quietly, as we're

still looking for that beachcomber job for the duration of the next world war.

» READING over the plans for the welcoming home of Mr. Archbold's expedition we note that "Members of the expedition will be flown from Floyd Bennett Field to Flushing Airport, then will be taken to the Aviation Building at the New York World's Fair. They will be received at the Fair by a welcoming delegation and will have an honor escort of Mounted Haskell Indians."

This information made us very sorry that we hadn't been selected as a member of the expedition, as our one overwhelming ambition has always been to have an honor escort of Mounted Haskell Indians.

» Now that the glider pilots at Elmira, N. Y. are making altitude records of over 18,000 feet, we think it is reasonable to assume that the engines which are not installed in their gliders are supercharged engines.

» AFTER looking over the Boeing Clipper at Port Washington, just before the start of the regular transatlantic service, The Intrepid Aviator remarked it was probably just as well he didn't have an airplane that big during his barnstorming days. Of course he would have been able to carry more passengers on each trip, but he noticed that the plane had a gas capacity of 4200 gallons and he doubted if he could have chiseled that much gas out of any farmer.

» HEYWOOD BROUN once made the remark that "Fame is as fleeting as a ferry-boat shoe shine", and this is particularly true of aviation, with improvements and new designs coming along so rapidly. So, with full apologies to Boeing and Pan American for seeming to detract from the glory of their remarkable achievements, we should like to predict a news item of a few years hence:

"The old Boeing flying boats, which were replaced on the ocean runs by much larger and faster equipment, are now doing good service on the 'jungle run' in Central America, hauling mining machinery and supplies to the inland lakes and bringing out the concentrated ore and a miscellaneous cargo including cypress logs. One or two of the flying boats are still being used by Pan American as training ships for the much larger equipment now in use."

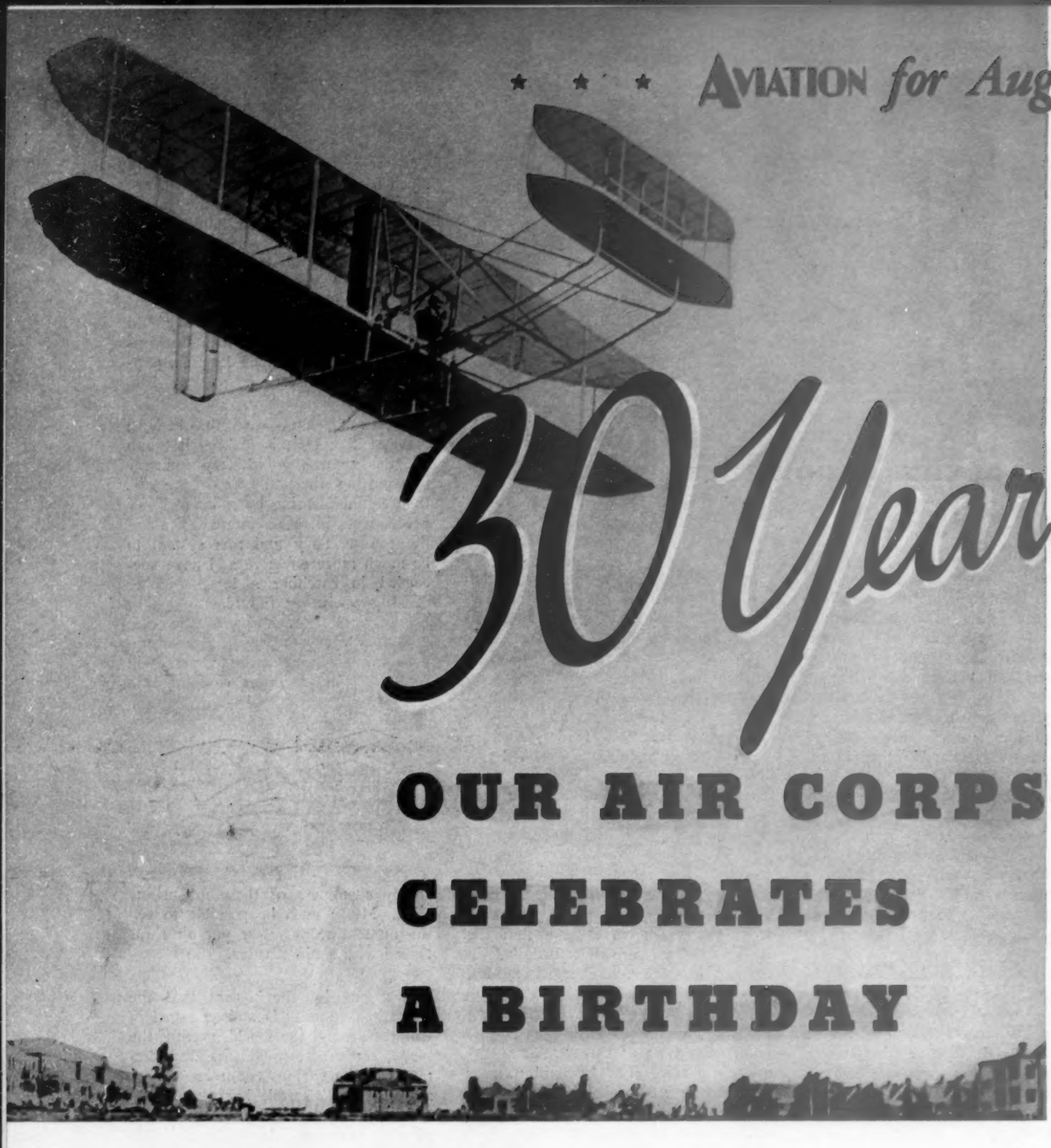
» DOWN GEORGIA WAY the Federal Alcohol Tax Unit is making it tough for the moonshine whiskey industry by spotting the stills from the air, then communicating by radio to other revenooers in cars following along the roads. They find this system to be much more effective and have succeeded in catching a large number of stills operating full blast.

Of course it's a poor rule that doesn't work both ways, so we suppose the airplane manufacturers will soon be selling similar equipment to

steady customers of these moonshine stills. Might even be possible to sell the mountaineers a few pursuit ships armed with squirrel rifles.

» WE SEE by the papers that the Hutchinson family is now engaged in a flight around the world, getting the kings, emperors, presidents and dictators of the various countries to sign a "good-will" scroll, having already obtained the signatures of the rulers in the Western Hemisphere. This scroll expresses a "fervent hope that this document will serve to strengthen world fellowship for the greater glory and welfare of human kind."

While we haven't the slightest doubt that the intentions of the Hutchinsons are of the highest, we think that world conditions are precarious enough without adding the risk of any more good-will flights. We dislike mentioning this complaint so often, but readers will recall that all this world unrest and feverish rearming began when the boys started making their first good-will flights along about 1927.



★ ★ ★ AVIATION *for August,*

30 Years

OUR AIR CORPS CELEBRATES A BIRTHDAY

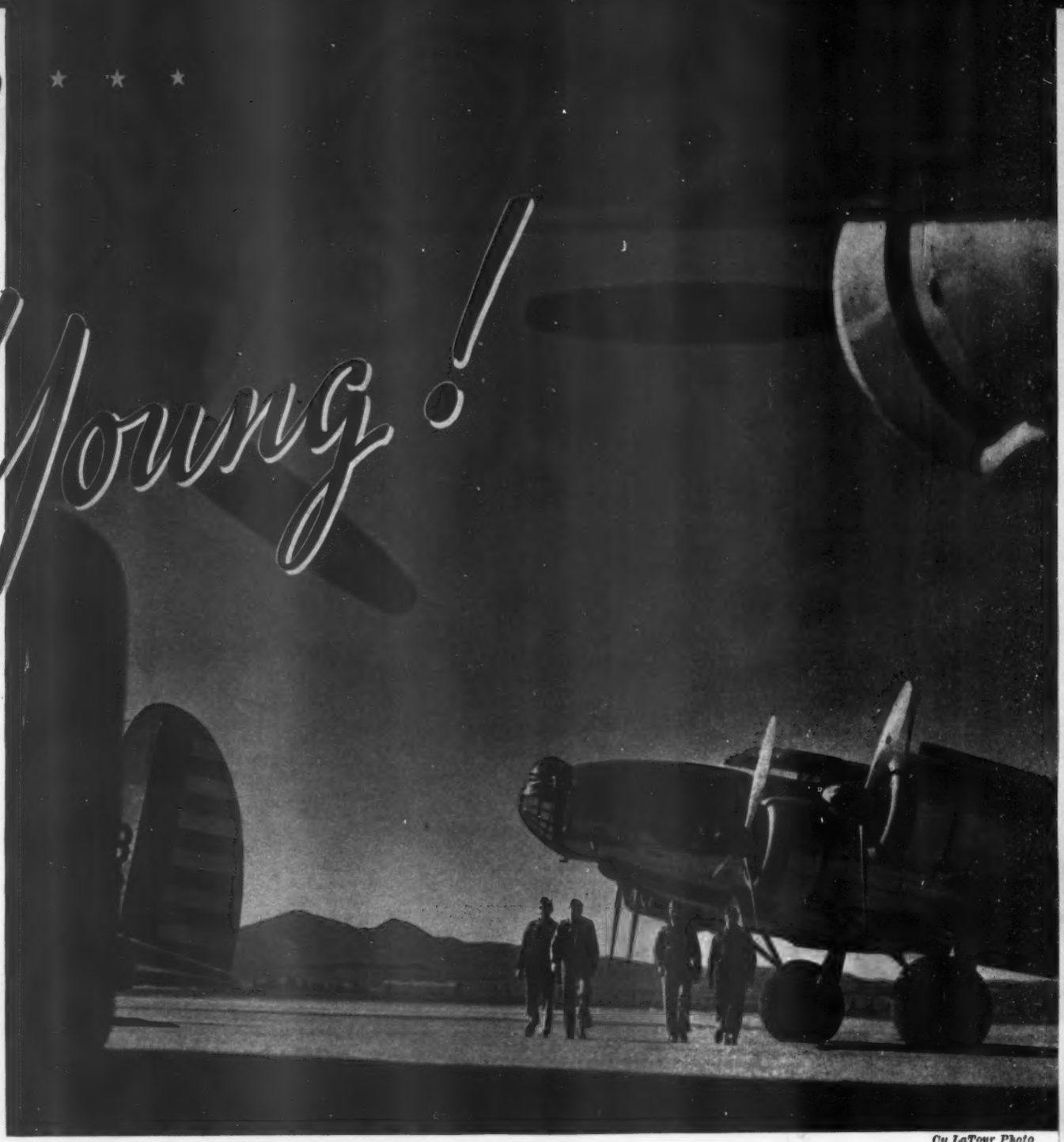
Not quite thirty-two years ago, the Chief of the Signal Corps of the United States Army issued a specification for a flying machine. Unlike most such specifications today, it was probably written without the least expectation that anyone could possibly meet it. It called for an aircraft of unheard of performance. It was to carry two persons, with sufficient fuel for a flight of 125 miles. It was to remain in the air for at least an hour, and during that time it had to be steerable in all directions without difficulty,—always under perfect control, after which it was to return to the starting point and land without any damage. A speed of 40 m.p.h. was desirable, with nothing less than 36 m.p.h. acceptable. Furthermore, it had to be quickly and easily taken apart for transportation in Army wagons (how the old Army mules must have laughed!) and put together again in operating condition in one hour.

Such rigid specifications may well have stumped the constructors of the day; all but two,—a pair of brothers hailing from Dayton, Ohio. By 1908 the Wrights set up at Fort Meyer, Va. a machine which might easily have met the requirements but for a minor fault. First result was tragedy,—the death of Lieut. Tom Selfridge, serious injury to Orville, and complete loss of the machine.

Not discouraged, by late spring 1909 they had another machine in readiness, and on July 30, with Orville

1939 ★ ★ ★

Young!



Cy LaTour Photo

Wright and Lieut. Benjamin Foulois up, the airplane successfully passed its speed trials. Later in the day, with Orville at the controls and Lieut. (now Colonel) Lahm as passenger, the machine set a world endurance record of one hour, twelve minutes!

Success! The specifications were met and the Army came into possession of its first airplane. To complete the contract, two officers were taught to fly—Lieut. Frederick E. Humphreys and Lieut. Frank P. Lahm.

Thus was born the United States Army Air Corps. This was the modest beginning of the first thirty years of service to the country that our Army flyers have just completed, a history that has included active participation in two wars,—a little one in Mexico, a big one in Europe. No less honorable has been its record in times of peace.

But it is a far cry from the flimsy Wright machine of 1909 to the Flying Fortresses of today. As Americans we can view with justifiable pride the technical developments, and the Service testing of three decades which have stepped speeds from a doubtful forty to a definite 400 m.p.h., ranges from a bare hundred to thousands of miles, and payloads from 300 pounds to many tons. With pride also we may look upon a personnel that ranks with the finest in the world.

Congratulations, Army! You have cut your eye teeth. Your adolescence is behind you and you now face the future in the full strength of your maturity.

The WRIGHT BROTHERS as Researchers

An appreciation of their early contributions to the aeronautical sciences.

Being an excerpt from the 27th Wilbur Wright Memorial Lecture read before The Royal Aeronautical Society, London, May 25, 1939

By George W. Lewis, F. I. Ae. Sc.

Director of Aeronautical Research, N.A.C.A.

THROUGH personal relationships with Orville Wright and through investigations of the early history of aviation it has been my privilege to attempt some estimate of the outstanding qualities and contributions of the Wright brothers. In their day the accomplishment not only of flying the first successful power-driven aircraft, but of constructing the research equipment to provide design data and of constructing both airplane and engine themselves was indeed remarkable. The methods and results deserve the term "modern" in the highest sense, in that they were far in advance of the contemporary art, and served as the basis for unprecedented practical applications.

Through the courtesy of Orville Wright some information on the Wright brothers' wind tunnel and the investigations conducted is available to me, and this subject will constitute the first section of this paper.

Fig. 1 shows two views of a replica of the original Wright brothers wind tunnel. The propellor was mounted to run in the circular ring just upstream of the straightening vanes. The tunnel itself was 5 feet long, and the test section was square in elevation, being 22 inches on a side. The speed attained was about 27 miles per hour, or 40 feet per second.

Fig. 2 is a reproduction of, I quote Orville Wright, "The original plottings (made December, 1901) giving the profile and plan form of some of the airfoils measured in the wind tunnel in 1901." In this figure I wish to invite your attention particularly to models 7, 8, 9, and models 10, 11 and 12. Here is shown the test programme for the first investigation conducted in the United States on a systematic series of aerofoils. Models 7, 8 and 9, it will be noted, are circular arc plates with systematically varied camber; models 10, 11 and 12 have the same amount of camber in a more forward location. These models

Fig. 1. Replica of the Wright Brothers wind tunnel

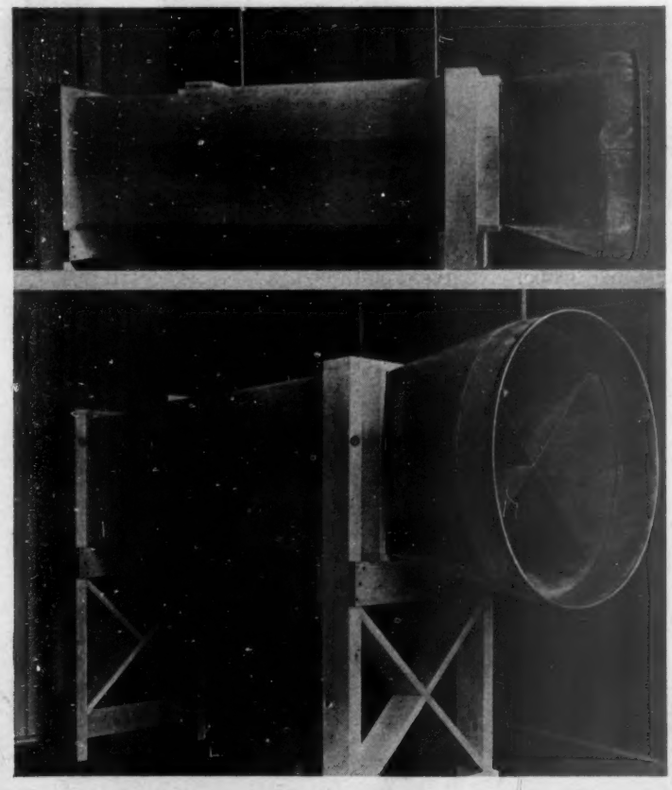
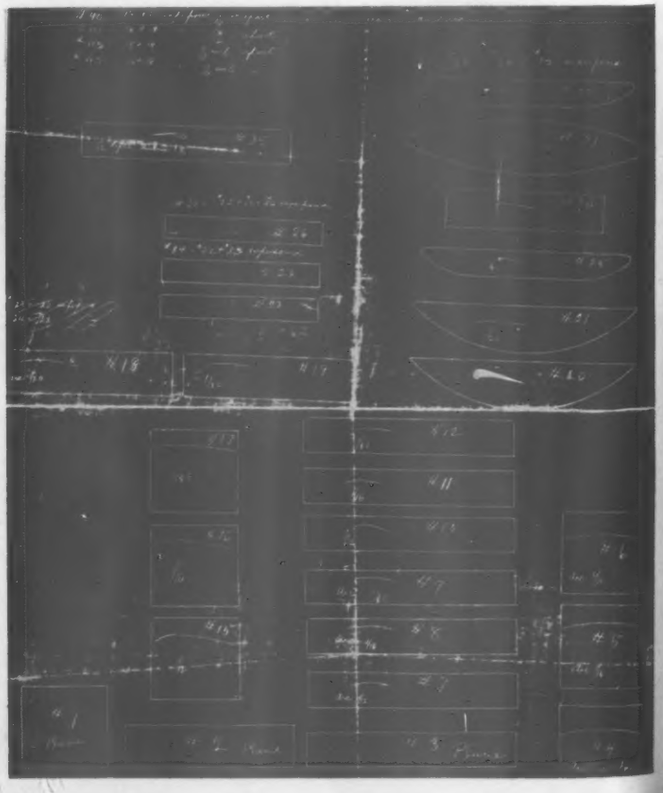


Fig. 2. Reproduction from the original research programme (1901)



had approximately 1 inch chord and 6-inch span, giving an aspect ratio of 6, now standard for aerofoil tests in most aerodynamic laboratories. Systematic investigations on the effects of plan form, aspect ratio, biplane gap-chord ratio, and some miscellaneous studies were also conducted.

This is indeed a surprising research programme for the year 1901. I wish to emphasize particularly the broad fundamental point of view it shows. So clear was the Wright brothers' appreciation of the basic factors in the problem that they included all but one of the important variables that have since concerned us in wing and aerofoil research. In this respect most subsequent research along this line appears mainly to have been in extension and refinement of this basic outline. Since it was never published, the research programme clearly bears the independent approval of eminent research scientists in this field, who have almost universally employed the same method of attack.

We turn next to the balances employed for measuring the forces. Fig. 3 shows a diagram and reproduction of a photograph of the original lift measuring balance. The legend, as follows, is Orville Wright's own description:—

Lift Measuring Balance

Letters correspond with parts shown in photograph and diagrammatic sketch, Fig. 1.

F—Frame. Mounted on floor of tunnel at 90 degrees to air stream.
D—Dial graduated in degrees.
P—Pointer mounted on axle A.
A, A—Vertical axles.
B, B, B¹, B¹—Horizontal arms mounted on axles A, A.
C—Cross bar swinging on arms B, B, B¹, B¹.
R, R, R, R—Resistance surfaces used instead of a square plane to avoid deflecting direction of air current striking surface S. They had no definite area themselves but together with the cross piece C had a pressure equal to that of a square plane of 8 square inch area, mounted at 90 degrees in the place of the surface S.
H, H, H, H—Horizontal arms mounted on friction sleeves T, T.
T, T—Friction sleeves fitting over axle A, A.
J—Cross bar supporting the surface S.
S—Surface to be measured mounted on K at various angles to be measured.
K—Mounting piece attached to J.

The pressure on the surface S tends to move the pointer P toward 90 degrees, while the pressure on R, R, R, R, tends to move the pointer back towards zero. Before taking a reading the arms H, H, must be adjusted always through the friction sleeve T, T, parallel to the air stream. Then the sine of the angle indicated by P multiplied by eight and divided by the area of the surface being measured, will equal the lift of the surface S in per cent of pressure on a normal plane of equal area.

The method of measuring drift, or drag, was equally ingenious. An auxiliary balance, shown in Fig. 4, was used. This balance measured the ratio of drift to lift directly as the tangent of an observed angle—a method which may appear tempting even now to the wind tunnel investigator, overburdened as he is with the calculation of induced interference effects. The photograph shows a replica of the original balance and the legend, as previously, is Orville Wright's description:—

Drift (Drag) Measuring Machine

Fig. 2 *represents diagrammatically the D/L measuring machine.*

H, H—Parallel arms mounted on axles AA.
C—Connecting links between arms HH.
S—Aerofoil to be measured, mounted on connecting links C.
E—Dial graduated in degrees.
P—Pointer attached to arm H.
R—Represents resultant of all pressures on aerofoil S.
L—Represents Lift.
D—Represents Drag.
Then tan angle HAH', as indicated by pointer P, gives D/L.
F—Frame (see photograph).

In practice we usually rotated the

(*Turn to page 81*)

Fig. 3. Sketch and photograph of the lift measuring balance (1901)

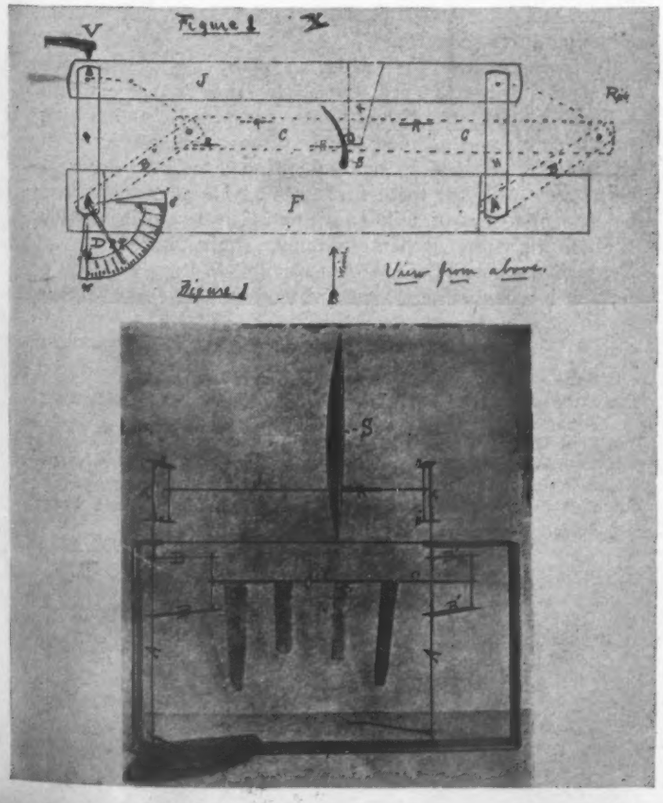
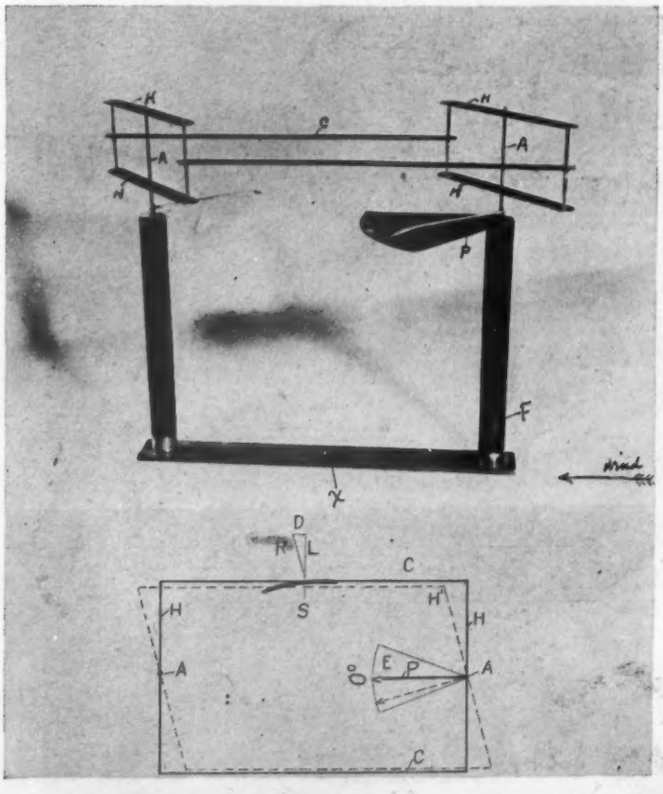
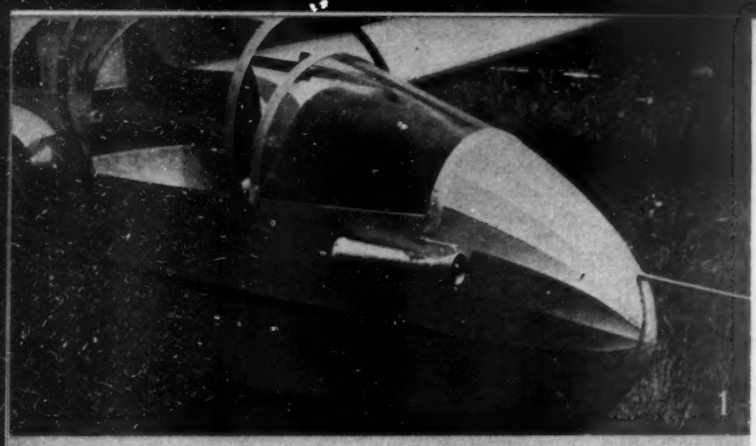
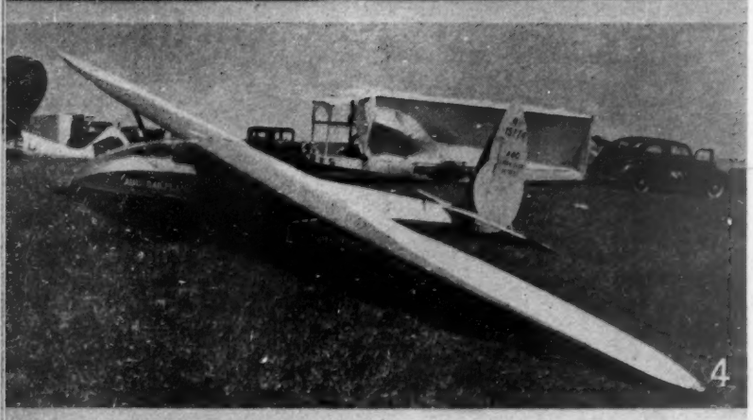


Fig. 4. Sketch and replica of the D/L measuring balance







Soaring's

The 10th Annual National Soaring Contest,

A successful meet with a flock of new records in the bag has created new enthusiasm and paved the way for a new era of soaring development in America.

By Maurice A. Garbell
Member, International Research Committee for Motorless Flight

THE 1939 soaring contest has given to the U.S. its first three Golden C's. To win them pilots must make a distance flight of at least 186.4 miles and reach an altitude of at least 9,820 feet above point of release. There are only about 25 Golden C's in the whole world. The intention of the International Research Committee for Motorless Flight in establishing this award, was to develop ability in cloud flying among soaring pilots. Under normal European meteorological conditions, and also under the conditions normally found along the American East Coast, it is almost impossible to gain more than 5,000 feet without climbing through a cloud.

It is interesting that after so many years when the American altitude record seemed to stick fast at a figure around 6,000 feet, three pilots succeeded in breaking through it to set a new mark three times higher than the old one. It is also remarkable that three very different ships were used for these flights. Only Decker's *Minimoa* belongs to a type of sailplanes previously tested in altitude flights. Ensign Robert Stanley, flight instructor at Pensacola, reached the new American record mark of 17,676 feet on his new ship *Nomad*, while John Robinson of San

1. **Nose of the fast and efficient Lawrence sailplane.**
2. **Warren Merboth did excellent work in this Bowlus-du Pont *Albatross*.**
3. **Emil Lehecka's *Rhonsperber* on a towing dolly.**
4. **The ABC sailplane that attracted attention in the 1938 meet.**
5. **A bit of fancy finishing on a modified Franklin.**
6. **Earl Southee and Arthur Lawrence manage to keep busy during the meet.**

Photos by the Author and Aviation Staff

Decennial

Elmira, N. Y., June 24—July 9, 1939.

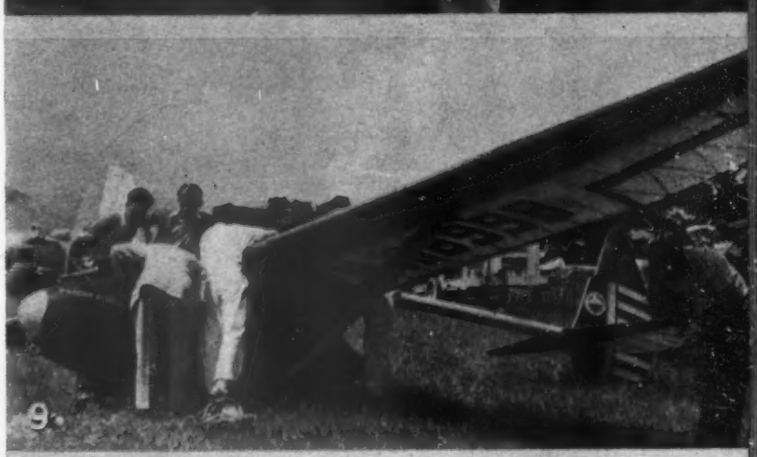
Diego, Cal., gained 11,000 feet altitude aboard his *Robin*, a metal-fuselage job based on a *Grunau-Baby* wing. Chet Decker's altitude was about 10,000 feet. A new American altitude record for two-seaters was also set during the contest by Barringer, former General Manager of the Soaring Society of America, on the Schweitzer all-metal sailplane. On July 4, he reached 6,710 feet above point of release with a passenger aboard.

All these altitude flights have been made by utilizing powerful cumulus clouds. They have been made possible by better blind flying training of the pilots and by better blind flying instruments on the ships.

The highest altitude ever attained on a motorless plane (30,000 ft.) was reached by the help of slope-generated currents on which it is possible to reach high altitudes without entering cumulus clouds. Wave currents are found behind mountains and hills in certain weather conditions, but the flights in Elmira had to be done exclusively under, and within cumulus clouds. This fact gives even more value to the altitude flights performed this year.

As for distance flights, a particularly difficult competition developed around the goal-flight to Harrisburg, Pa., 130 miles from Elmira, which was finally won by Bob Stanley, on the SSA *Ibis* in 4 hrs. 39 min. The greatest distance ever flown in an Elmira contest was Chet Decker's flight in his *Minimoa* on July 2, when he landed at Atlantic City, N. J., 233 miles away. This figure, however, is not up to the American record of 280 miles, recently established by Woody Brown during the Wichita Falls contest in Texas.

Duration flights nowadays have lost practically all their technical interest. It is remarkable, however, that the soaring pilots at Elmira normally have about seven hours



7. Chet Decker in the machine in which he made the Atlantic City flight.
8. Harvey Stevens looks over his *Baby Albatross*.
9. Thunderbird, the only Bowlus *Baby Albatross* at the meet.
10. Floyd Sweet preparing to take off in the SSA *Elmira*.
11. 12. Familiar sights on the assembly lines every day. Even the gals lend a hand where necessary.

13. Carl Lange checking over instruments with one of the contestants.
14. The Weather Bureau boys busy checking barographs for the day's flights.
15. Mike Gluhareff of Sikorsky (lower right) discussing the aerodynamics of sailplanes with an interested group.
16. The Aviation Trophy Award Committee at work. Left to right, Jacobs (N.A.C.A.) Lawrence (SSA), Hammon (CAA).

at their disposal for distance flights, while at the Rhön (Germany) the average duration of good thermal conditions is about six hours.

Two completely new designs turned up at this year's contest, *Nomad* by Bob Stanley, and Don Lawrence's sailplane. *Nomad's* wing is a straight tapered type of wooden monospar construction. Its section is N.A.C.A. 23012. It is rigged with 1 degree of washout. The Stanley fuselage is of sheet dural, carries a single retractable landing wheel, no tail skid. The hood over the cockpit is retractable but not detachable. Greatest novelty in Stanley's design is the form of the tail, with combination rudder and stabilizer set 90 deg. apart (45 deg. from the vertical). Thus, two tail surfaces serve the same purpose as the more usual three. By means of a very simple mechanical hookup, stick movements are normal. In this way Stanley has obtained not only a simpler and aerodynamically cleaner tail arrangement, but has also eliminated the aerodynamic troubles which affect the normal tail due to the proximity of the wing. With this design it should be possible to install spoilers nearer to the fuselage to improve stability while gliding steeply with spoilers open without producing disconcerting tail buffeting.

The Lawrence ship has a wooden wing and a fabric-covered steel tube fuselage. Of particular interest were the wing root attachments and the folding feature on the horizontal tail surfaces. The single landing wheel has a skid in front of it. The wing has a 54 foot span. It uses the N.A.C.A. 2418 section at the root and N.A.C.A. 2412 at tip. The wing is in gull form, tapered throughout its length. It is rigged with 2½ deg. geometric washout.

Also outstanding were the all-metal jobs of the Schweitzer brothers, and the *Baby-Albatross* by Bowlus. The Schweitzers had two of their well-known two-seaters on the field (one belonging to the SSA and one to the Airhoppers) and a new utility sailplane, a sort of improved edition in steel and aluminum of the Austrian Hütter 17. Besides setting a new altitude record for two-seaters, the Schweitzer sailplanes have made many new friends for soaring by providing some flying experience for a number of people as co-pilots or passengers.

The Bowlus ship is based on the *Grunau-Baby* wing and has an aluminum tail-boom. It is sold in kit form for home-assembly (see page 38). One of these ships (built from a kit) made the recent 280 mi. record flight in Texas.

Officials at Elmira had the responsibility of running a three-ring circus. Down at the airport Hank Wightman, general manager of the Soaring Society, was busy with the CAA instructors and students assigned for gliding and soaring. In the Administration Building on Harris Hill Dr. Eastman Jacobs, Platt, Klemperer, Lange, Franklin, Wolf Hirth and many others kept hot discussions going on practically every technical and scientific phase of motorless flight. On the field quite a crowd of spectators had to be entertained with flight exhibitions and loud-speaker

announcements. Finally, there was a soaring contest running. All this was done smoothly and without undue excitement. Every morning at 8:30 there was a pilot meeting where Mr. Wiggin of the U.S. Weather Bureau presented the analysis of the weather conditions and gave an idea of the probable developments during the day.

THE radio and teletype communications service deserve to be mentioned. As soon as a sailplane had taken off and had started flying toward the pre-announced goal, its ground-crew started navigating in the same direction with tow-car and trailer. The pilot had only to advise the Elmira headquarters on his landing, and the message was broadcast immediately over New York, New Jersey, New England, and Pennsylvania by the police teletype. Thus the ground crews had only to cruise from one police-station to another, waiting for their message. A record of some sort was established when two Airhopper cars arrived at the State Police Office at Harrisburg, Pa. at 9:00 P.M. on July 2, asking for Emil Lehecka's landing message. The message was not very complicated because Emil was sitting right behind the police station with his *Rhönsperber*.

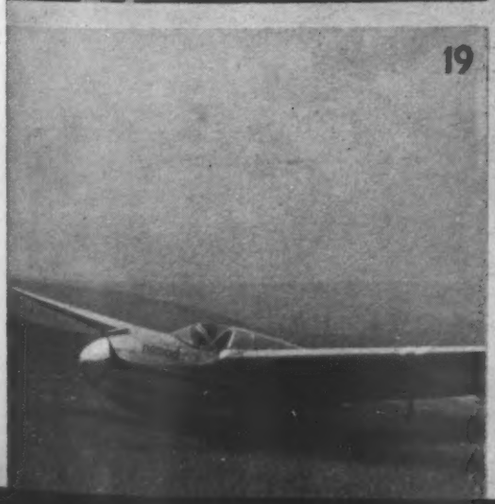
17. Trophy winner, Robert Stanley, before his altitude record flight on July 4th.
18. The unconventional tail surfaces of Stanley's *Nomad*.
19. Stanley in *Nomad* about to take off.
20. Detail of end plates on *Nomad's* ailerons.
21. AVIATION'S trophy for outstanding sailplane design for 1939 won by Stanley and *Nomad*.

A PROBLEM which seems to have been handled not too satisfactorily, and which certainly should be worked out better next year, is that of the take-off facilities. Many promising moments were lost because the winches were not available or were tied up for mechanical difficulties, or because airplane towing was too expensive for many of the pilots. It would be advisable also to have the number of towplanes proportional to the number of high-performance sailplanes, in order to be able to get planes and pilots back rapidly from distant airports. A high percentage of distance flights end on airports and tow-flight back to Elmira would give extra comfort and extra sleep to the pilot and would help save money. In fact, the fuel consumption of a heavy car, especially on holiday-congested roads, would seem to give an advantage in favor of the airplane.

Practically every discussion among technicians and pilots at Elmira posed the question:—how can we get permanent soaring schools?—how can a National Research Center for Soaring be erected as a necessary complement to the N.A.C.A. research work and as technical and scientific center for existing and future soaring groups? Naturally, the work must be started on a very limited scale, for instance by giving a few capable and energetic fellows the task of doing a well-organized construction and research work not in their own interest but for the benefit of all American soaring. Such a baby research center might easily grow with its own achievements exactly as similar institutions have done in other countries.

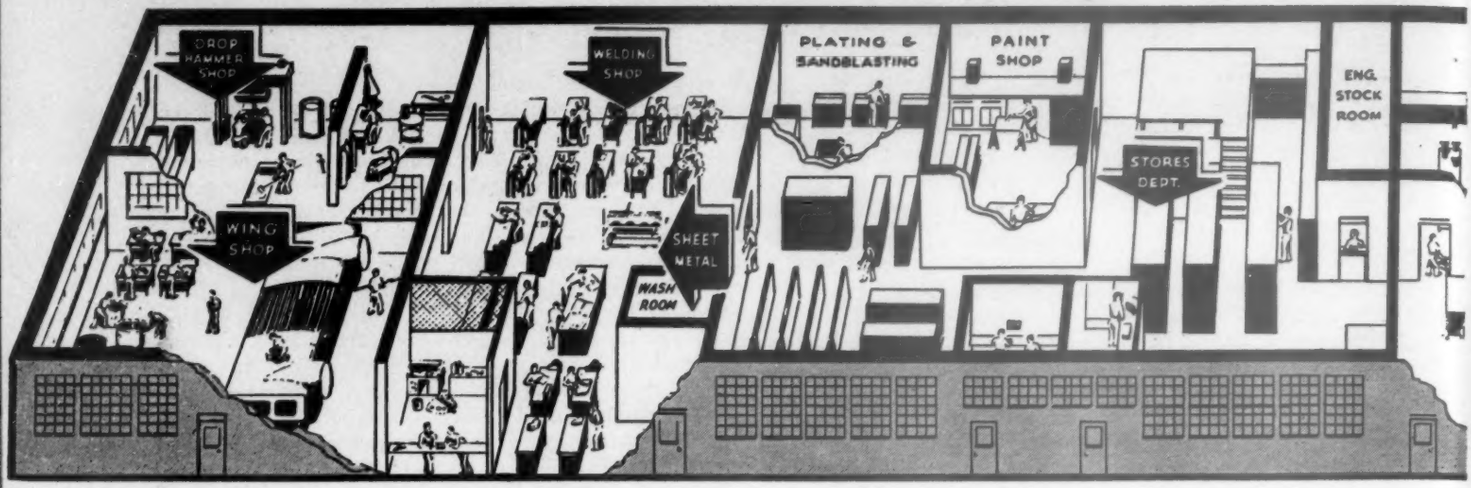
17

18


19

20

21



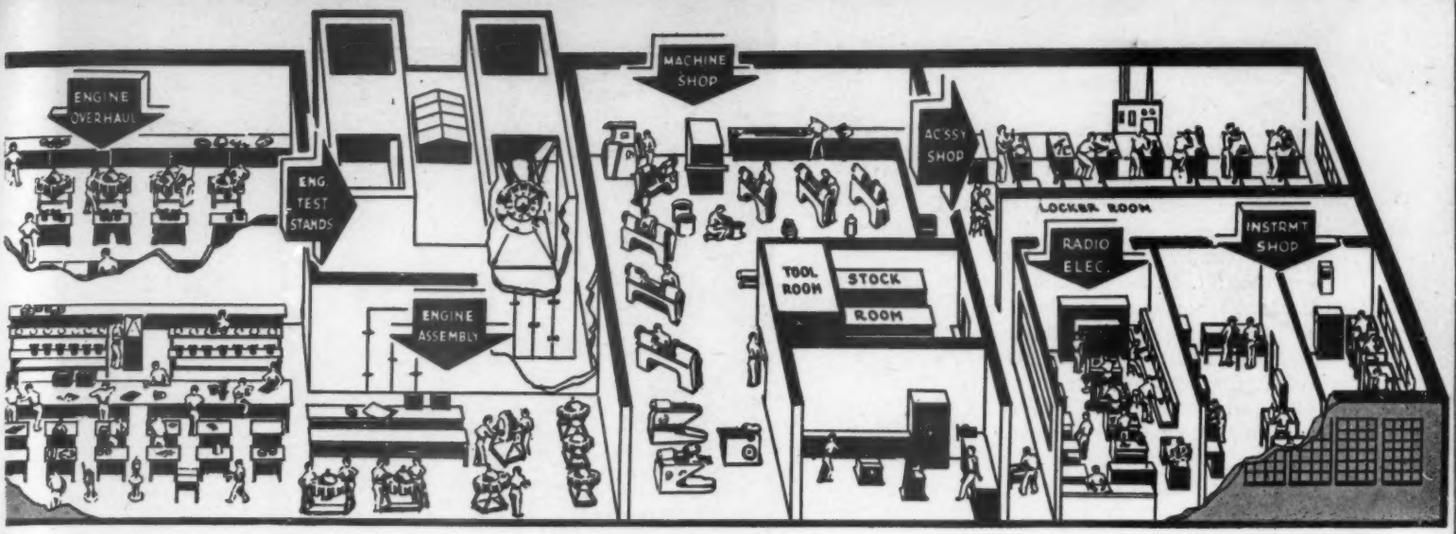
Cheyenne with the LID OFF

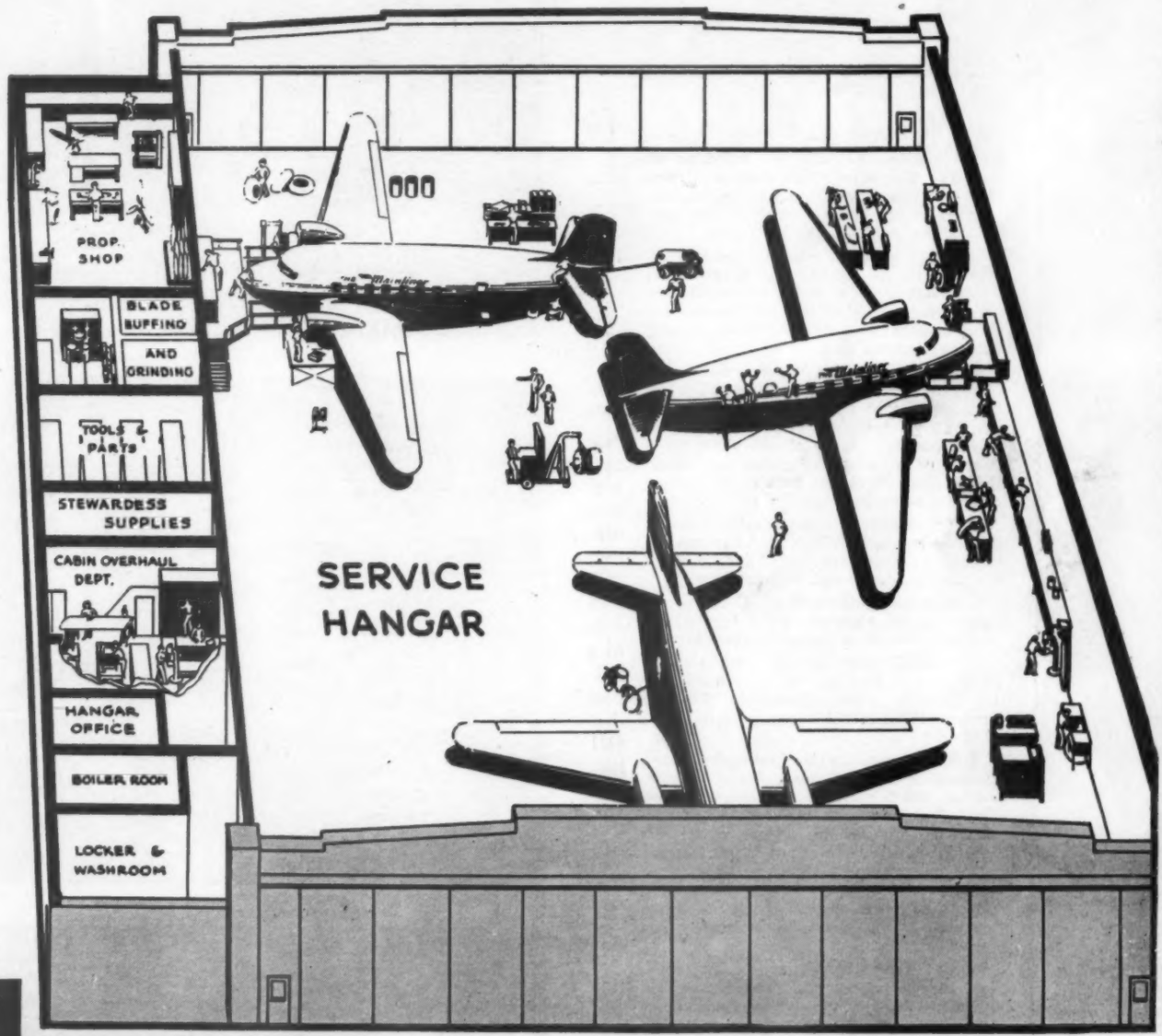
Not a tale of the old Wild West, but a quick look behind the scenes in the shop that won for United Air Lines AVIATION'S MAINTENANCE AWARD for 1939.

CHEYENNE is one of the oldest aircraft maintenance points in the United States. Its history began with the establishment of the air mail service in the early twenties, and its use as a servicing point has been continuous to date.

The increasing demand for schedules, plus the constantly increasing size of airplanes, has kept the plant in a constantly expanding state. Visible in the picture below are the rounded tops of the original hangars that were built to house the early DH-4 mail planes. By roofing over the gaps between the original hangars, and by linking the walls together, United has succeeded in retaining much of the original construction without causing any reduction in efficiency of flow through the enlarged plant. The service hangar (right) was built long after the original hangars and was originally designed to accommodate ships of the Boeing 80 type and larger. It easily takes care of the present Douglas Mainliners.

By constant rearrangement of the elements of the overhaul base as required, by changes and service, United has evolved one of the most efficient maintenance bases in the world. A great deal of the credit goes back to the days when Oliver West (now with Trans-Canada) had charge of United engineering, but the good work started by West has been ably continued under the direction of Base Superintendent W. P. Hoare and his Cheyenne staff. Base personnel now includes J. W. Eberly, director of per-





These excellent drawings of the Cheyenne Maintenance Depot with lid removed were made especially for AVIATION by Mr. Cloyd Hoover of the Engineering Staff, UAL. They illustrate the truth of the old Chinese proverb that one picture is worth a thousand words.

sonnel; A. Trumbull, foreman, radio & electric shop; C. M. Peterson, foreman, propeller shop; E. A. Bennett, foreman, cabin overhaul; E. Waugh, foreman, machine shop; D. Stombaugh, foreman, sheet metal shop; R. K. Moore, assistant auditor; J. Bolhoffer, foreman, battery shop; J. B. Leonard, inspector; C. A. LeMasters, foreman; F. Wallace, test pilot; E. U. Fairbanks, assistant chief engineer; H. F. Salisbury, assistant superintendent, repair base; W. C. Conradt, foreman, engine overhaul; B. Thompson, hangar maintenance; L. J. Krentz, foreman, accessory department; A. J. Carvell, foreman, plane overhaul; L. D. Bean, foreman, instrument department.

"It Takes All Kinds—"

Many and varied are the activities at United's Cheyenne Maintenance Depot. Most of these scenes may be spotted readily on the shop lay-out on the preceding two pages. As for details:

1. After overhaul, each of the Pratt & Whitney 14 cylinder engines is given an 8-hour test run, swinging a calibrated test "club". One of the two suspended, shock-mounted test stands. A single control room serves both.

2. These refuelling trucks, developed jointly by United and Standard Oil carry 2000 gallons of gasoline, 200 gallons of oil. They are fitted with two engine driven pumps capable of delivering gasoline at 100 gallons per minute per pump. United now has eleven such trucks spotted at major service points.

3. An engineering department has recently been established at Cheyenne to handle new projects and design work for the Overhaul and Repair shops.

4. Airplane maintenance, upholstery repairs, engine changes, final inspections, etc., are carried on in the Service Hangar.

5. General view of the engine overhaul shop. Benches in foreground are for cylinder work. Assembly lines in center. Note use of mercury vapor lighting.

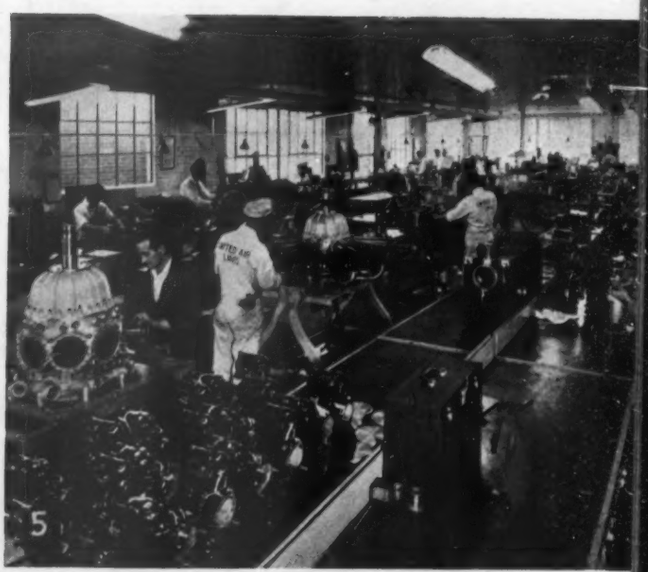
6. Prime requisite for instrument maintenance is a clean shop. At Cheyenne, an air filtering system provides dust-free air. The shop is divided into three sections—(a) an overhaul and repair department for instruments requiring extreme precision work; (b) another containing a greater part of the test equipment; and (c) a third room containing the necessary machinery and storage for gasolines, oils and other supplies.

7. Cheyenne is the main distribution and control point for all stores and supplies used over the entire system. A portion of one of the stock rooms.

8. The Hydromatic propellers used on all United Mainliners come through this shop for periodic check and overhaul. Many special tools and fixtures have been developed at Cheyenne to simplify propeller servicing and maintenance.

2

4


5

7

8

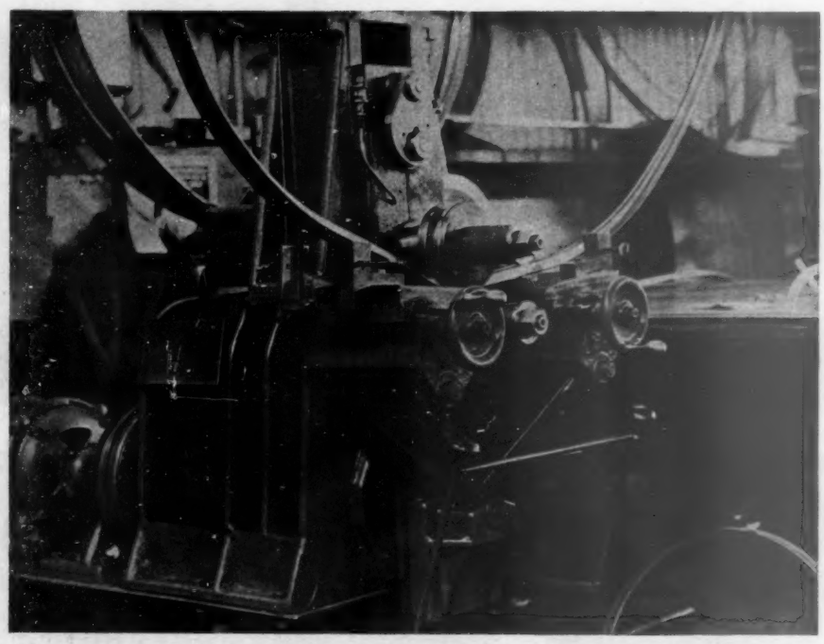
Vultee's
Special Machines

In a previous article the author discussed attachments and fixtures for standard machine tool equipment. The concluding installment covers machines designed specially for aircraft work.

By Don I. Carroll

MACHINE processing operations in the Vultee plant are rather sharply divided between the machine shop proper and all other applications of machinery to airplane building. The latter are frequently novel or highly specialized; standard machine tool applications were discussed in a previous article. For convenience special aircraft machine equipment can be subdivided into three general classes. The first is profiling equipment, which is used for cutting sheet metal or extrusions accurately to a predetermined pattern. The second, forming equipment such as presses, drop hammers and power brakes, is used for shaping sheet metal into various, and often quite complex, forms. Finally, there is the assembly equipment, which includes special production jigs, special riveting machines and electric-welding machines for seam and shot welding.

The second of two articles prepared by Mr. Don I. Carroll, Plant Manager, Vultee Aircraft Division Aviation Manufacturing Corporation, with C. F. McReynolds, and published in cooperation with American Machinist.



Rolling a fuselage ring from channel stock of hat-shaped section. Designed and built in the Vultee plant, this machine rolls channels from flat stock and round or odd-shaped rings from formed or extruded channels.

In our forming shops we have employed the power brake, hydraulic press, punch press, drop hammer, and other such equipment for the economical manufacture of complex sheet-metal parts. The power brake is used for forming angles and various types of straight sections from flat sheet material. The hydraulic press has found wide application in the aviation industry and is invaluable for forming very large sheet parts, as well as many different small parts in a single set-up. We use the hydraulic press for forming, flanging, and shearing in one operation, as on wing ribs. The toggle press is a mechanical variation of the hydraulic press. This tool is now being used by North American Aviation and may find application elsewhere. Its basic advantage is high-speed operation for certain types of pressing. The punch press, used largely for blanking operations on parts not greater than 12 in. across, is gaining popularity in connection with the Continental die process. The Continental dies are produced with the Do-All machine, cutting flat dies from cold-rolled boiler plate of $\frac{1}{2}$ or $\frac{3}{4}$ in. thickness. By this process it is possible to produce a die and punch quickly with little hand work. The punch is carburized and the set-up is extremely simple. Cost of this method is about one-third that of normal die costs and the work is entirely satisfactory for limited production runs. Piercing and blanking operations are largely performed with the punch press, although many simple forming operations are also done.

The fuselage assembly bay with its rotating jigs.

The drop hammer is in some respects our most versatile forming tool, making possible the production of some parts which could hardly be manufactured by any other process. The presses and drop hammer together make it possible to use double-curvature sheet-material parts that would otherwise be too expensive; thus, they contribute to the aerodynamic efficiency of the airplane as well as to economy of production.

Machine men generally are familiar with the new aircraft drop-hammer technique, which employs zinc and lead dies in connection with a free-fall hammer to stamp shapes in aluminum-alloy or steel-sheet material. We have contributed our share of improvements to the technique, including use of multiple progressive dies for deep forming operations, rubber blankets or pads for coaxing metal into difficult corners, and many other detailed refinements of the operation. But we believe our greatest contribution to be our application of production methods to the entire drop-hammer process.

Double-Rope Hammers

Also in the drop-hammer shop proper we have increased production per man hour through design and manufacture of our own hammers. These are characterized by unusually rugged construction, with very heavy cast-iron beds, or anvils, and overhead "hammers." As is customary, we use a rope lift working from an electrically operated friction drum, but for the sake of safety we use a double-rope lift system, and a double system of safety latches. This makes it physically impossible for the hammer to fall unless deliberately dropped at the will of the operator.

Operation of the hammers is made more satisfactory through the design of the support system for both power drum and hammer head. The former is supported on four heavy members widely spaced and mounted in foundations entirely separate from the base of the hammer. The hammer base extends out to give support to heavy vertical arms, rigidly attached to the base, which guide the hammer head in its fall. This construction assures perfect alignment. The hammer base is mounted on a system of timbers which extend down to a sub-surface concrete base. A system of spot lights is mounted on the hammer power-drum support pedestals so as to provide the operator with light sources to reach into all parts of the die or work during stamping operations. Hammershop work is further quickened through provision of work layout tables adjacent to the hammers in such a way that the work is accessible with minimum effort both before and after stamping.

Flanges for the center section wing spar are extruded sections routed to the desired profile. The profiling machine is adapted from standard wood working equipment.

One of the major forming problems at Vultee has been the production of circular or oval rings for fuselage stiffeners and other purposes. We could not find any equipment satisfactory for this purpose and finally designed our own machine, which is relatively simple in construction, and extremely efficient in production. The machine consists essentially of a set of two rollers mounted one above the other and driven at variable speed in either direction. Alongside the lower roller are two tilting tables, accurately controllable, to feed the work to a desired curvature. The roller dies may be interchanged on their mounting shafts to provide for a wide variety of channel-shape forming.

With this machine we roll straight channel sections from flat strip sheet

(*Turn to page 78*)

SIMPLIFYING
Stress Analysis

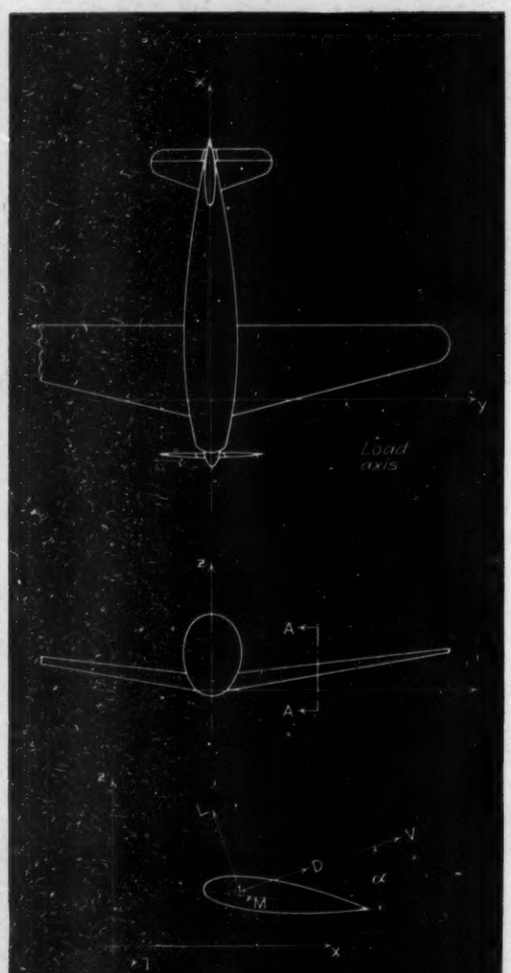


FIG. 1

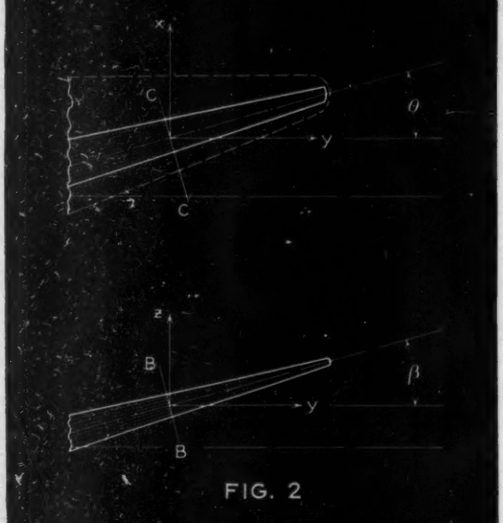


FIG. 2

By F. R. Shanley

Chief Engineer, Curtiss Wright Technical Institute
Structures Staff Engineer, Lockheed Aircraft Co.

IN VIEW of the ever-increasing complications in the stress analysis of modern metal structures it is always good news to hear about any simplifications that can be effected. It may be worthwhile, therefore, to point out a few recent developments that may not have become generally known to structures engineers.

Load Axis—In determining the external loads and bending moments acting on a wing structure it is easy to become confused because of the presence of dihedral, sweepback, variations in elastic axis position, and other such factors. The use of an arbitrary "load axis" has special advantages in that it entirely divorces the external load determination from the geometry of the internal structure. The *load axis* is simply a straight line drawn normal to the plane of symmetry of the airplane. It may be located at any convenient point, preferably somewhat ahead of the wing and either completely below or above it. Once located, it serves as a reference axis for all subsequent calculations of wing and tail loads. Standard conventions for loads and torques should be adopted, as indicated in Fig. 1.

Regardless of the methods used for load distribution and summation, it is possible to transfer all loads and torques to the load axis and to resolve them into components along the chosen reference axes. (Torques should of course be designated by vectors representing the axis of rotation.) This permits the computation of curves of shear, bending moment, and torque with reference to the load axis. In the actual process the tabulation will include the distances from the aerodynamic center to the load axis at the various spanwise stations.

The main advantage of this system is the fact that a great deal of computation work can be completed before the internal structure of the wing has been decided upon; and in cases where the elastic axis (so-called) of the structure is not a straight line, the load-axis method eliminates the torque corrections that must be made while "moving" shear loads over a wandering path.

Another feature of the load axis is the fact that balancing tail loads are influenced only by torsional moments about this axis. It is therefore possible to utilize the total computed torque about this axis for balancing purposes. In the procedure used at Lockheed the entire process is carried out in terms of aerodynamic coefficients, resulting in a set of general curves for tail load in coefficient form. These curves remain unchanged as long as the geometry of the airplane is not altered and they can be used for any design condition. Incidentally, the need for a mean aerodynamic chord disappears entirely, from a structural standpoint, and it becomes possible to use an approximate M.A.C., simply as a yardstick to measure c.g. position.

Dihedral and Sweepback Effects

After the wing loads have been determined with reference to the load axis they must eventually be applied to the basic wing structure. This usually involves a determination of some sort of shear center or structural axis (a process that will be discussed in greater detail later in this paper). To transfer the external loads to this shear center it is only necessary to make a correction in the torsional moment about the load axis. The loads and torques now act at the right place, but not necessarily in the right directions. What *are* the

Of special interest to structural engineers, as it represents results of actual application of modern stress analysis methods to practical problems. The author is chief engineer of the Curtiss-Wright Technical Institute at Glendale, Calif., and Structures Staff Engineer for Lockheed Aircraft, Burbank. We are pleased to add this article to the long list of notable technical contributions which Mr. Shanley has made to AVIATION.

right directions? This simple question is not so easy to answer in some cases, but a few elementary principles can be applied to clarify the point.

Let us assume a condition such as shown in Fig. 2, where the solid lines represent the basic wing structure. The vectors x, y, and z may represent either loads or torques. The first and most obvious principle to apply is that the internal loads should be found by "cutting" the structure *through the minimum cross-section.* In Fig. 2 the proper cutting plane is illustrated by the lines B-B and C-C, which can be regarded as traces of the plane. The determination of the cutting plane in this manner simply amounts to assuming that the structure behaves in the same way regardless of how it happens to be attached to the fuselage. Obviously it will be necessary to resolve forces and torques into different planes and directions at the fuselage attachment, and there will also be some question of "end effect." But for most stations outboard of the fuselage the structure should be regarded as independent of conditions at the root of the wing. (In some cases the *minimum cross-section* principle may have to be further modified, such as when stringers do not run normal to this cross-section.)

The final step is, of course, to resolve the forces and torques into new planes determined by the plane of minimum cross-section. This can be done at the same time the external loads are moved to the structural axis. But when the dihedral or sweepback angles are not large it becomes advisable to determine the errors that would be introduced by ignoring these effects entirely. It will be found that these errors can be taken care of by simple correction factors in most cases.

Corrections for Dihedral and Sweepback

Knowing the correct procedure, it is possible to evaluate the errors introduced by *cutting all sections parallel with the plane of symmetry.* The approximate correction factors have been tabulated in Table I. In arriving at these values certain assumptions were made, such as:

(a) Wing area used in load factor computations is the projected area.

(b) The air pressure acting over a certain actual area of wing is unaffected by dihedral. (This assumption results in the correct total vertical load.)

(c) In computing section properties the *nominal* areas of stringers, corrugation loops, etc., are used, even though the section is taken at an angle with the stringers.

It can be seen from Table I that when the angles involved are small nearly all the correction factors become negligible. This enables the analysis to be made with a minimum of work. It will often be sufficient to make a correction for only one or two items.

The derivation of the correction factors is a straightforward mathematical process, the details of which need not be included in this paper. When such factors are to be used in the analysis they should be derived for the case in question, as differences in type of construction may require different assumptions to be made. Table I is included here only to give a general idea of the magnitude and nature of the correction factors.

TABLE I

Correction Factors

	Symbol	Dihedral β	Sweepback θ
Air Loads			
Vertical Shear	P_z	$1/\cos\beta$	———
Chord Shear	P_x	———	$\cos\theta$
Beam Bending	M_x	$1/\cos^2\beta$	$M_x\cos\theta - M_y\sin\theta$
Chord Bending	M_z	$M_y\tan\beta$	———
Torsion	M_y	1.0	$M_y\cos\theta + M_x\sin\theta$
Axial Load	P	1.0	———
Inertia Loads			
Vertical Shear	P_z	$\cos\beta$	———
Chord Shear	P_x	———	$\cos\theta$
Beam Bending	M_x	———	$M_x\cos\theta - M_y\sin\theta$
Chord Bending	M_z	$M_y\sin\beta$	———
Torsion	M_y	$\cos\beta$	$M_y\cos\theta + M_x\sin\theta$
Axial Load	P	$P_z\sin\beta$	———
Section Properties			
Beam — Moment of Inertia	I_x	$\cos^2\beta$	$\cos\theta$
Chord — Moment of Inertia	I_z	$\cos\beta$	$\cos^2\theta$
Beam — Static Moment	Q_x	$\cos^2\beta$	$\cos\theta$
Chord — Static Moment	Q_z	$\cos\beta$	$\cos^2\theta$
Enclosed Area	A	$\cos\beta$	$\cos\theta$

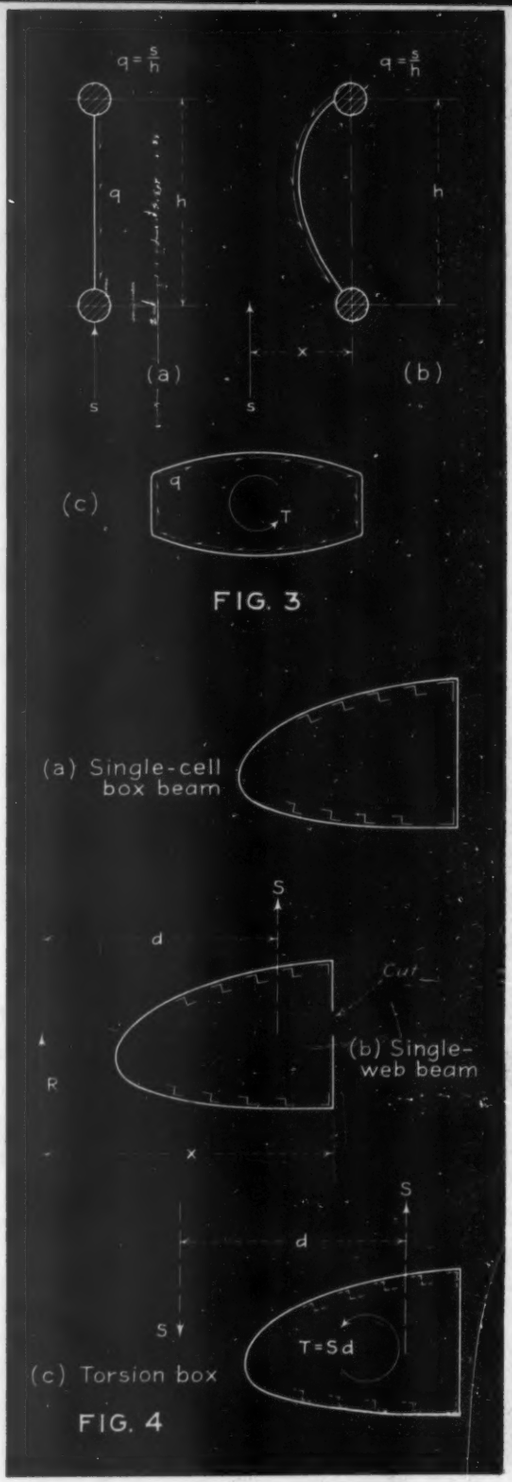


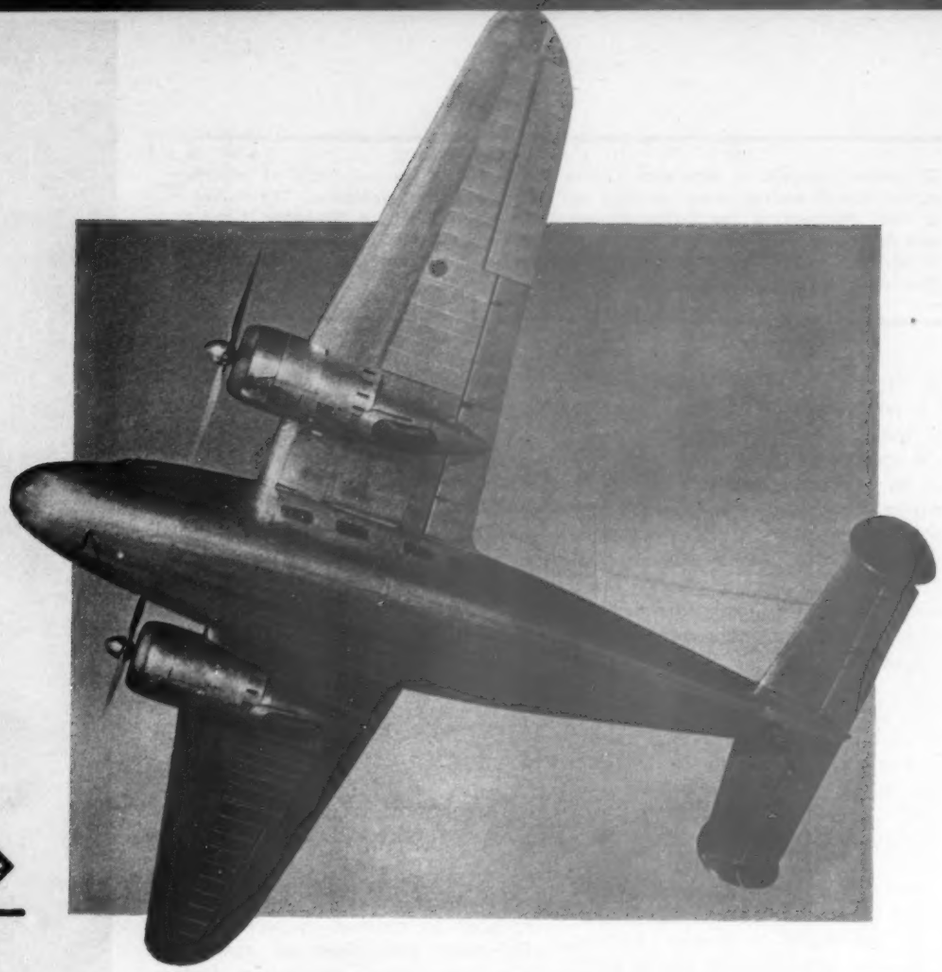
FIG. 3

FIG. 4

Chord Coefficients

A considerable simplification in the determination of "chord" loads can be effected if we make use of a simple aerodynamic fact. If we know the lift coefficient for a given section or strip of wing, the corresponding chord coefficient is immediately determined and *is unaffected by aspect ratio.* This follows from the fundamental assumptions made in determin-

(*Turn to page 47*)



Flying Equipment

DE HAVILLAND FLAMINGO

DESIGNED as a general purpose transport the DeHavilland Flamingo is available in capacities of 12, 17, and 20 passengers for operation on wheels, floats, or skis. It is somewhat unusual in that it is a high wing monoplane. Equipment includes Handley Page slotted flaps which increase the lift about 40 per cent when fully lowered and may be used for take-off at a setting of about 25 deg. at which point the lift increase is about 25 per cent.

Simplified maintenance is gained by extensive interchangeability of structural units such as the two landing gear assemblies, port and starboard engine installations, and others. One of the two 900 hp. Bristol Persens sleeve-valve engines may be replaced within an hour.

Above: Vision is excellent and space plentiful in the pilot's cockpit in the nose of the Flamingo.

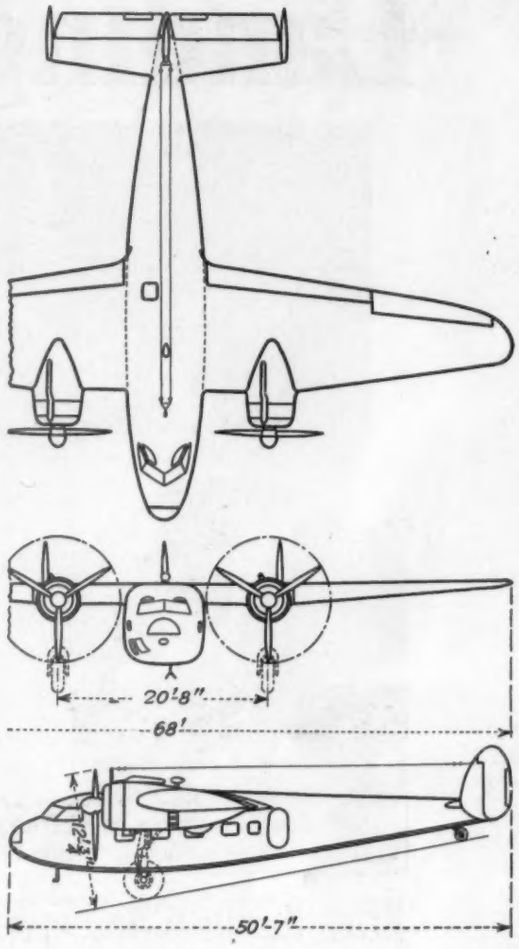
Left: There is ample room for the comfortable armchairs and sufficient aisle space in the wide cabin.

The soundproofed cabin is exceptionally roomy being 7 ft. wide and 6 ft., 7 in. at its maximum height. Wide armchairs are placed three abreast with ample aisle space between rows. The entrance door is only 27 in. above the ground. The 12 passenger version carries a crew of three and has a block-to-block range of 1310 miles. For twenty passengers, a crew of two is specified and the block-to-block range is 600 mi.

General specifications are as follows:

Span, 68 ft., (20.70 m.)
Length overall, 50 ft., 7 in. (15.45 m.)
Height overall, 15 ft., 3 in. (4.65 m.)
Wing Area (inc. center section), 639 sq. ft. (59.3 sq. in.)
Gross weight, 17,000 lb., (7710 kg.)
Payload (1000 mi. range), 2613 lb. (1182 kg.)
Payload (500 mi. range), 3505 lb. (1585 kg.)
Maximum speed (7500 ft.), 243 m.p.h. (391 km./hr.)
Cruising speed (5000 ft.), 227 m.p.h. (365 km./hr.)
Service ceiling, 18,500 ft. (5650 m.)

The landing gear wheel units are interchangeable and the three blade De Havilland propellers provide ample ground clearance.



Not only width but plenty of cabin length give adequate leg-room even when the armchairs are in reclining position.

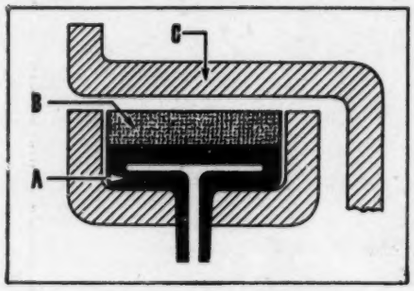
New Goodrich E.T.* Brakes Landings To All Planes

GIANT BOEING B-17 TYPE "FLYING FORTRESS" EQUIPPED WITH 20-INCH GOODRICH E. T.* BRAKES . . .

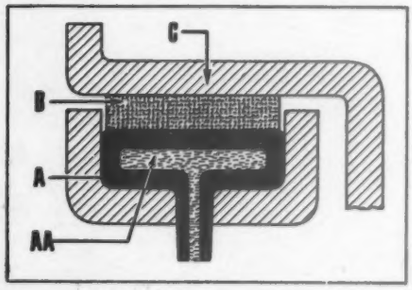
One of the many four-engined planes built by Boeing Aircraft Company for the United States Army Air Corps. The Goodrich E.T.* Brakes used on these giant bombers have 22 times as much braking surface as the installations on many of America's popular light sport planes.

CLOSE-UP VIEW OF THE 20-INCH GOODRICH E. T.* BRAKES ON A BOEING "FLYING FORTRESS"

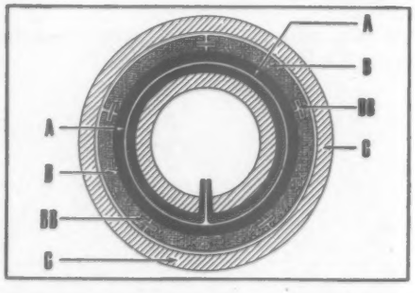
HOW GOODRICH E.T.* AIRPLANE BRAKES WORK



1 Cross-sectional view showing the Goodrich E.T.* Airplane Brake released. The Expander Tube (A) is deflated, the sectional brake block (B) retracted, and the wheel (C) free to turn.



2 The Expander Tube (A) is inflated with braking fluid (AA), forcing the sectional brake block (B) against the brake drum (C), bringing the plane to a swift, smooth, safe stop.



3 The full circle of sectional brake blocks (B) is joined together by metal retractor springs (BB). When the Expander Tube (A) is inflated, these brake blocks press *evenly* against the brake drum (C) all the way around. When the Expander Tube deflates, the springs retract, pulling the brake blocks back from the drum and letting the wheel turn free without drag.

The New Goodrich

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — — Rubber Hose — Grommets — Shock Absorber Cord — A Complete Line

Give Smoother, Safer Whether Large Or Small

1939 PIPER CUB COUPE EQUIPPED WITH 5-INCH GOODRICH E. T.* BRAKES

A handsome, safe, easy-to-fly plane that gives the sportsman-pilot many extras at no extra cost. Among these "extras," Cub owners get the safety and smoothness of landings with Goodrich Airplane Silvertowns and the new Goodrich E.T.* Brakes.

New Expander Tube Principle Provides Extra-Safe, Extra-Smooth Landing Control for Every Size and Type of Plane

TODAY, everything from half-ton sport planes to "Flying Fortresses" are making quick, safe, smooth landings on the perfect combination of Goodrich E.T.* Brakes and Goodrich Airplane Silvertowns. And it's the utter simplicity of this new brake design that does it!

The new Goodrich E.T.* Brake has only three basic elements—the Expander Tube, the brake block and the retractor spring. Working together these simple, fool-proof elements are absolutely controllable and non-self-energizing. Thus there is practically nothing to get out of order or require repairs. And this brake automatically compensates for lining wear, giving much better service at peak efficiency.

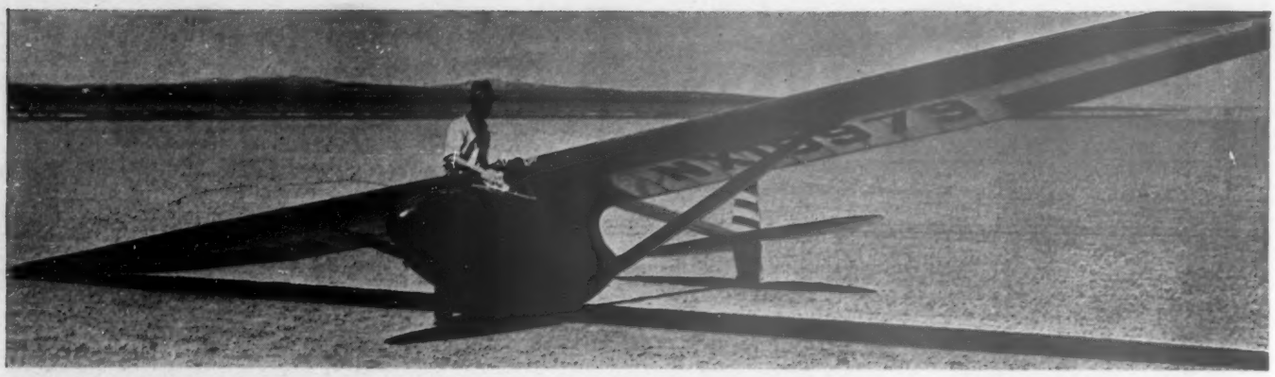
Whether your planes are large or small —whether they're built for private, commercial or military flying—"step up" their landing control now with Goodrich E.T.* Brakes.

*Goodrich *Expander Tube* Brakes are manufactured under license and sold by Hayes Industries, Inc., Jackson, Mich., and Bendix Aviation Corp., South Bend, Ind.

CUB OWNERS GET EXTRA-SAFE LANDING CONTROL WITH THE 5-INCH GOODRICH E. T.* BRAKE SHOWN ABOVE . . .

E.T.* Brakes

Abrasion Shoes—DE-ICERS—Matting of Rubber Aeronautical Accessories.

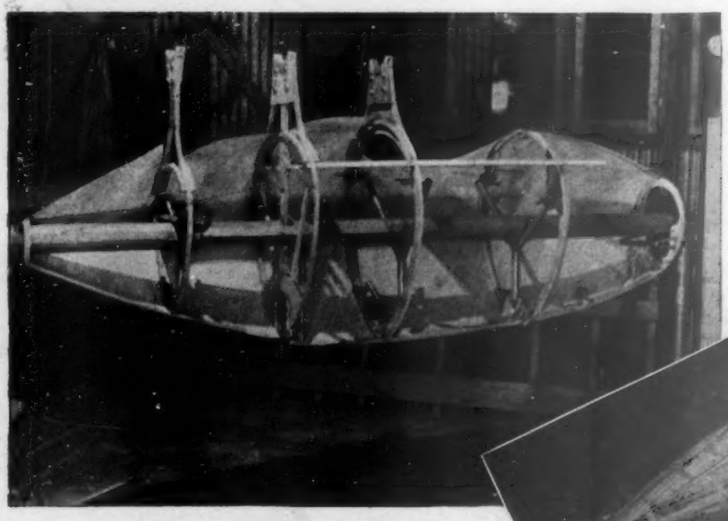


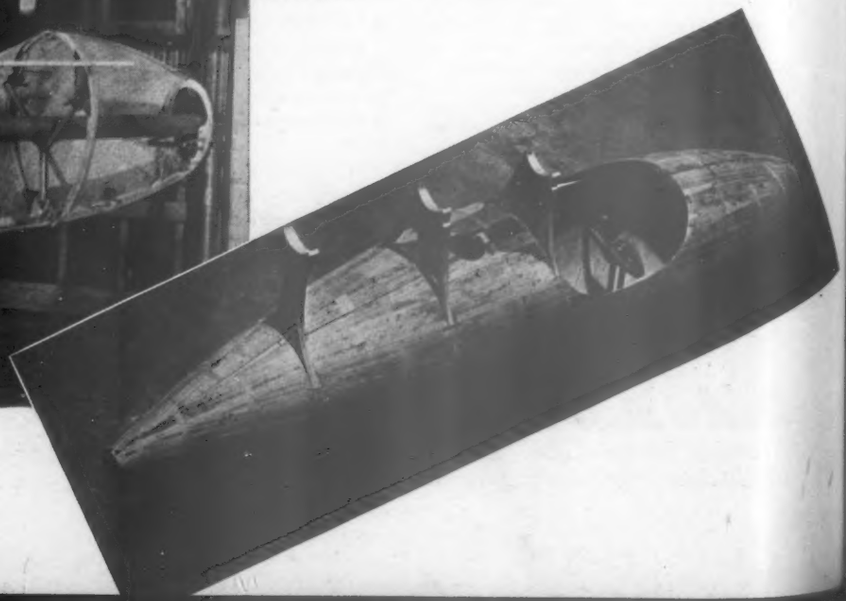
Bowlus Baby Albatross

In his years of motorless aircraft design experience Bowlus has evolved many types, but none so characteristically American, and so definitely original, as the Baby Albatross. Bowlus is not building complete planes, but prefers to stress a kit plan which provides the purchaser with parts that are 85% completed in the factory, but on which all the detailed finishing, assembly, etc., is left to the individual builder, or club. Under this plan the kit is supplied in ten units; the builders starting with the simplest part of the ship, the rudder, and progressing through the elevators, struts, fins, etc., until the plane and its builders have progressed together to the point where one is a finished article, the other a finished workman. This procedure lowers the cost of the plane materially, teaches the purchaser many things that he should know about his plane before he tries to fly it, makes him a better mechanic for continued maintenance of the plane, and greatly widens the possible field of sailplane construction through providing interested groups with a properly engineered design, and with parts that are 85% factory finished.

Under the Bowlus purchase plan the complete kit may be bought in ten increments for a total cost of $385. For another $5 one can obtain complete blueprints of the carrying trailer that has been developed for transportation on the ground. The complete plane, factory finished, may be had for $800. The approved purchase plan calls for a $75 down payment, which covers two units, the rudder, and elevators. A second payment of $50 brings units 3 and 4, the wing struts and the fin unit. Payment of $125 acquires the largest item, the two wing units, Nos. 5 and 7. These come with the spar and leading edge complete except for finishing, and with all ribs assembled, ready for attachment. In fact, throughout the kit, all major structural units, such as pod, tail boom, and wing spars, are finished at the factory to insure proper strength of the plane's primary structure. Unit 6, the ailerons, costs $25. And units 8, 9, and 10 are lumped in a $110 payment, covering the pod, boom, and miscellaneous finishing parts and materials. All fabric coverings are sewed at the factory ready for installation. Detailed instructions are supplied throughout.

In general design the Bowlus Baby Albatross is a strut-braced high wing monoplane of wood construction. There is no fuselage proper, pilot accommodations being provided by an abbreviated nacelle, or "pod", of three-ply veneer glued and pressed in a mold to a perfect streamline form and glass-like finish. The pod has a landing





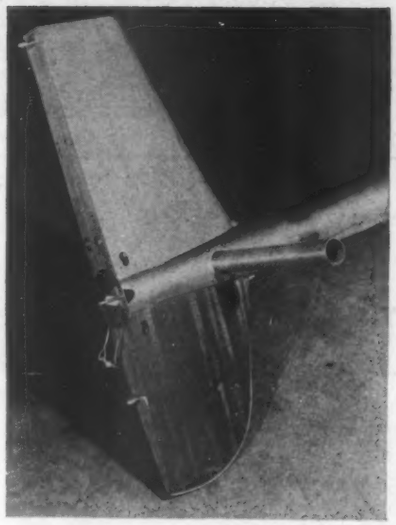
Structural details and the finished "pod" of the Bowlus Baby Albatross

skid and take-off wheel. Tail surfaces are carried on a dural boom attached to the pod through three laminated fuselage rings. Wing is of mono-spar type with a single strut for each panel.

The wing is of elliptical plan form, and is tapered in thickness from the inboard end of the aileron, although straight across to that point. Airfoil section is Göttingen 535 half way to the tip and then modified to a symmetrical section at the tip. No spoilers or flaps are used as it is claimed that the Baby Albatross will land at 27 mph, and will do a three hundred and sixty degree turn in ten seconds.

Fittings throughout the Baby Albatross are of cast aluminum alloy.

Span of the ship is 44 feet and weight 205 lb. Gliding ratio is normally 20 to 1, and best flying speed is 45 mph.



Fin construction of the Baby Albatross

The uncovered wing structure

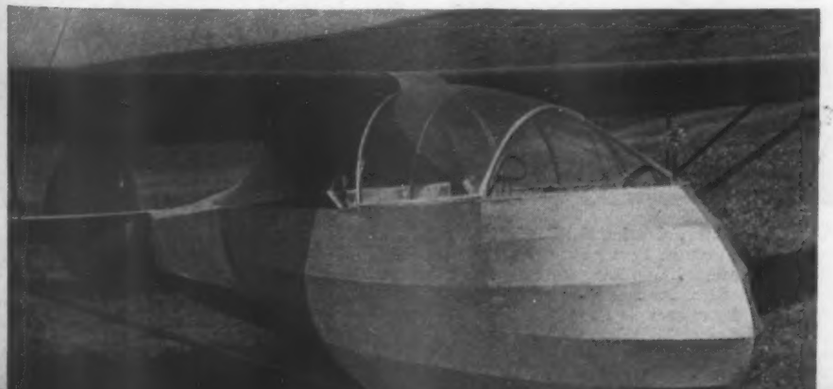
Briegleb Utility

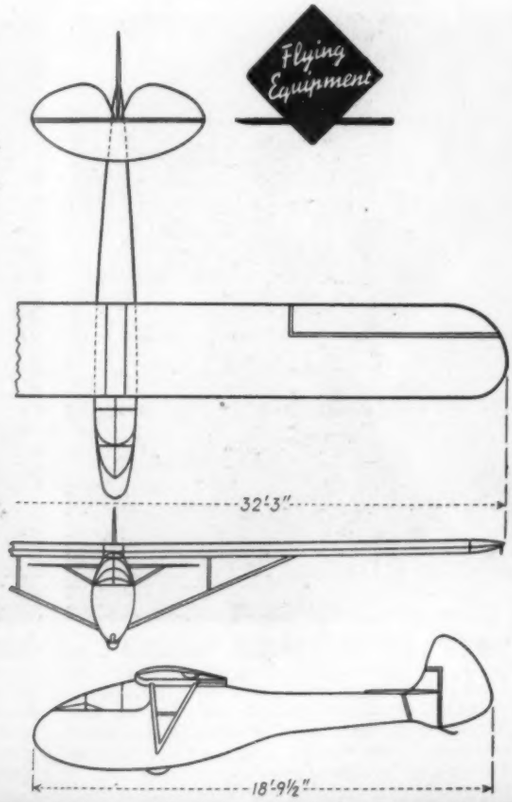
ONE of the most promising sailplane designs from the standpoint of commercial application, is the Model BG-6, Briegleb Utility Glider of rugged design for student instruction work, but with strong soaring potentialities. Of very light empty weight, and all-around small dimensions, the Briegleb BG-6 is of conventional strut braced parasol monoplane type, with fully enclosed cockpit. Differential ailerons are sufficiently sensitive to provide lateral control at only 10 mph. A push-pull system is used for aileron and elevator controls. The plane may be set up ready for flight by two men in twelve minutes. 1010 steel tubing is used in the fuselage structure. A 12 in. commercial wheel and tire are used for landing and take-off, in addition to a nose skid and a tail skid. The glider is designed for a top speed of 80 mph for airplane towing.

A unit-sales plan has been worked out to encourage home builders, or club groups who wish to assemble the ship themselves. A variable purchase plan includes the following possible steps: Complete plans, working drawings, and detailed instructions, $12.50; Complete plans and all raw materials, $175.00; Plans, materials, and all metal work finished, including all welding and fittings, fuselage, etc., $275; Complete sets of finished parts, ribs, spars, etc., all ready to assemble, $345.00; or the complete Utility, factory-built, $495. A further step has been developed by which groups may purchase the parts in five or ten units. Under this plan the plane is subdivided into such component parts as ribs, ailerons, elevators and rudder, etc., and these units can be supplied step by step until the job is ready for assembly, spreading purchase over a period of five or ten months, on the basis of one unit per month, or even longer if necessary or desirable.

Briegleb BG-6 specifications

Span	32 ft. 3 in.
Length	18 ft. 9½ in.
Airfoil	NACA 4412
Aspect ratio (effective)	8.9 to 1
Wing area	117 sq. ft.
Empty weight	180 lbs.
Gross weight	370 lbs.
Wing loading	3.2 lbs. per sq. ft.
Gliding angle	16.5 to 1
Sinking speed	2.8 ft. per sec.
Stalling speed	30 m.p.h.





BENDIX RADIO

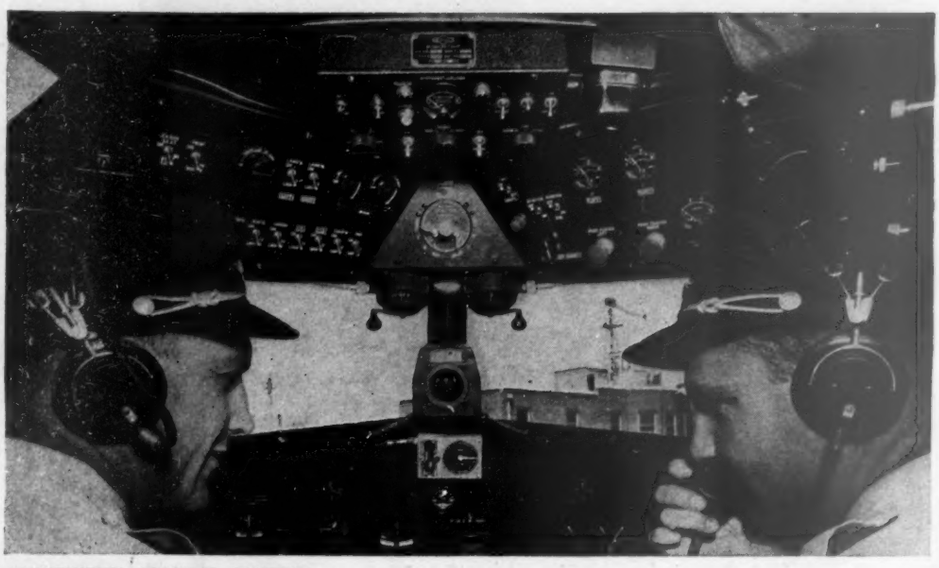
BENDIX AIR RADIO NEWS

AUGUST 1939 Published by BENDIX RADIO CORPORATION, Baltimore, Md. Cable Address BENRAD

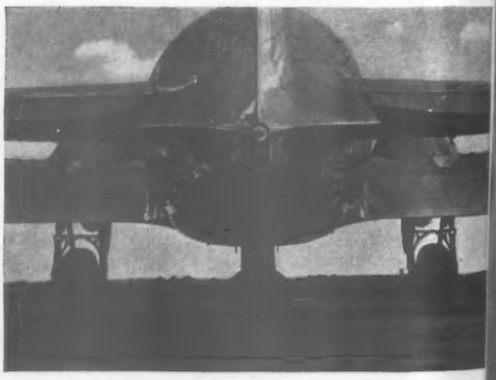
NORTHWEST NEW DC-3'S EQUIPPED WITH BENDIX TA-2 TRANSMITTERS

8-Channel, 100-Watt Units Provide Improved Communication, Increased Safety.

Bendix Aircraft Receivers, Compass Units, Ground Station Equipment Also Used By Northwest.

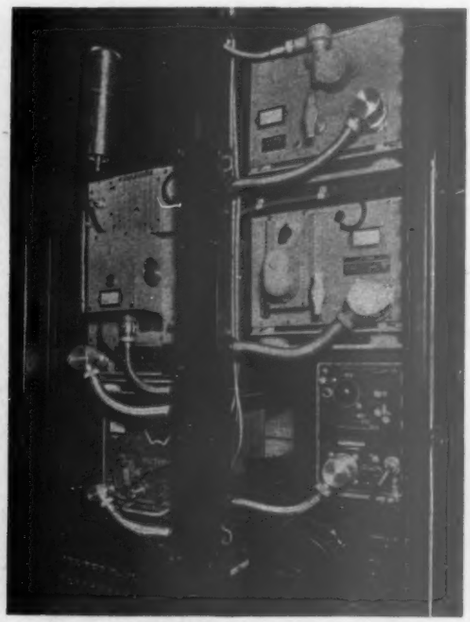


CONVENIENT COCKPIT CONTROL, with Control Units of the Bendix TA-2 Transmitter, Receivers and the Direction Finder within convenient reach of the flight officers. Captain George C. Kruse (left) and First Officer T. W. Franklin are in the cockpit.



BENDIX STATIC CARTRIDGE in tail of a new DC-3. Operated from flight cockpit, the cartridge releases a trailing wire in series with a high resistance which continuously and noiselessly discharges static accumulations from the metal body of the airplane.

BENDIX LOOP INSTALLATION. The MN-20 Loop is mechanically rotated from the Flight Cockpit. Its small size and highly developed static shielding reduce air drag and assure reliable operation. The loop is connected to the receiver through a low impedance transmission line thus allowing it to be located in the most advantageous position.



RADIO COMPARTMENT, showing the Bendix TA-2 Transmitter, High Voltage Power Supply and the DC-3's Communication, Radio Range and Auxiliary Receivers. The TA-2 Transmitter is electrically controlled from the flight cockpit to give 100 watts output on phone, CW or MCW on any of 8 pre-set channels.

NORTHWEST'S GROUND STATIONS are also Bendix Radio-Equipped. At Minneapolis, the operator controls two Bendix Ground Station Transmitters and four communication receivers. One transmitter and two receivers can be switched to another operator in the administration building if desired.

Super Scarab at 165 h.p.

New Warner Engine Has Take-off Rating of 175 hp.

PRODUCTION is now under way on the newest Warner engine, following official approval by the CAA of the new Super Scarab Model 165 seven cylinder radial engine with a normal maximum power rating of 165 h.p. at 2100 rpm, and an approved take-off rating of 175 h.p. at 2250 rpm.

The crankcase is made in two halves, joined at the centerline, of ribbed and heat treated aluminum alloy castings. A heat treated machined steel bearing cage is inserted in the rear half, and two bronze bearing sleeves are shrunk and pinned into place in the front half, to provide mountings for the crankshaft main ball bearings, insuring permanent accurate alignment, and preventing local bearing loads from being transmitted directly to the soft alloy metal of the crankcase.

Connecting rods are "I" section steel drop forgings. The master rod is of split type, four-bolt design, with a replaceable high lead bronze steel backed bearing shell at the crankpin end. Link rods are assembled to the master rod big end by means of wrist pins locked in the link rod and bearing in bronze bushings drilled to provide full forced feed lubrication. Bronze bushings are pressed into the piston end of all rods for the piston pins, which are of full floating type. Pistons are heat treated aluminum castings fitted with two compression rings and one oil ring, in addition to an oil collecting groove.

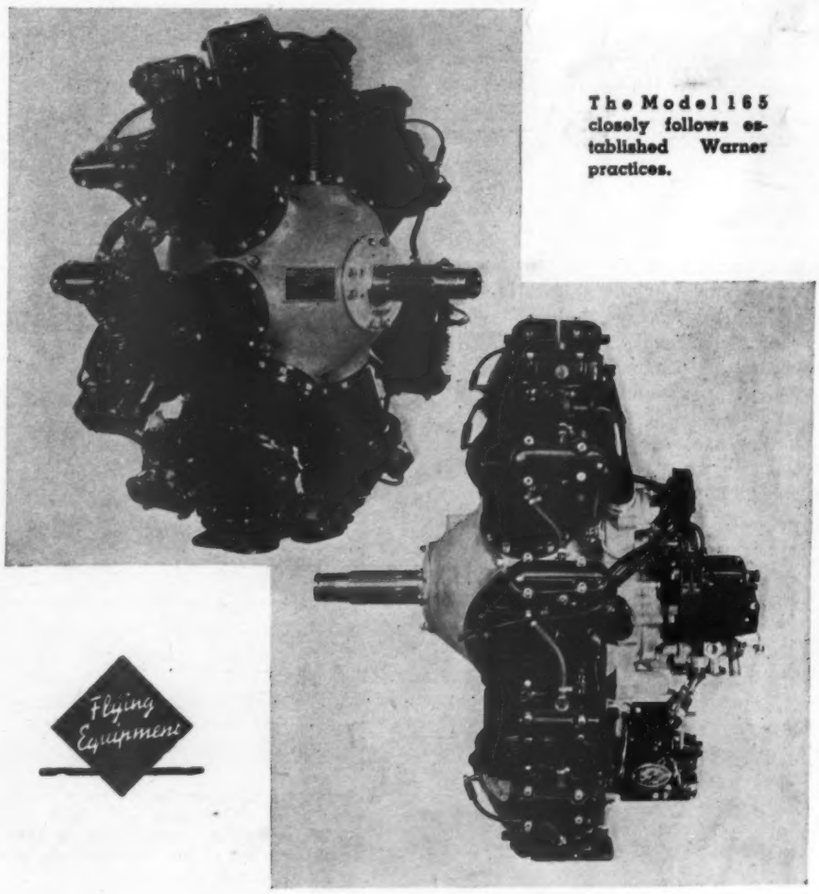
Complete cylinder assemblies are attached to the crankcase by eight studs each. Cylinders are alloy steel forgings machined all over, and amply finned. An improved type cylinder head is cast in aluminum alloy and is permanently shrunk and bolted to the cylinder. Exhaust and intake ports are at the rear of the cylinder head. Exhaust valve and seat are of austenitic steel. Intake valve is cobalt chrome steel and the intake valve seat is aluminum bronze. Intake and exhaust valve guides are of bronze. Two spark plugs are fitted to each cylinder.

Rocker arm housings are cast integral with the cylinder head and fully enclose the valve mechanism which is automatically lubricated through pressure feed to the rocker arm bearings of No. One cylinder, with gravity feed to the remaining rocker boxes. The scavenging pump picks up excess oil from rocker boxes on cylinders Nos. Four and Five.

The cam ring is made from an alloy steel drop forging, is machined all over, and is carried on a replaceable bronze bushing which floats on the heat treated main bearing sleeve. The crankshaft is generously proportioned and is machined from a one-piece drop forging, heat treated. The propeller-end carries an SAE No. 20 spline. Mounting pads are provided on the gearcase for starter, generator, fuel pump, tachometer drive, and two additional accessory drives, as well as drives for two flange mounted magnetos. The induction housing is bolted directly to the rear crankcase, and also serves to support the engine on its mount. The carburetor is attached to the lower part of this induction housing and separate intake pipes lead to each cylinder.

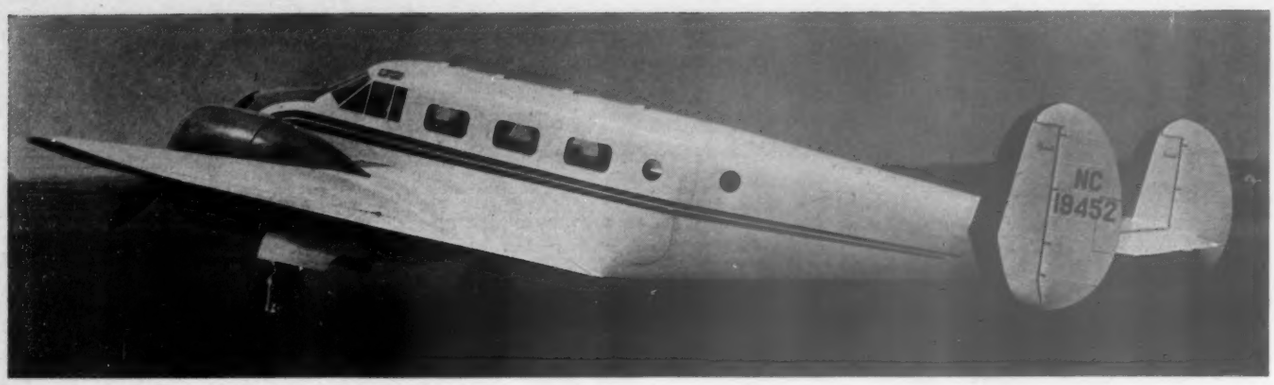
Specifications are as follows:

Bore	4⅜ in.
Stroke	4½ in.
Piston displacement	499 cu. in.
Standard compression ratio	6.4 to 1.
Rated speed	2100 rpm
Rated power	165 h.p.
Take-off speed	2250 rpm (controllable propeller)
Take-off power	175 h.p.
Cruising power (75% of rated hp)	124 h.p.
Weight dry without hub or starter	332 lbs.
Ignition	Dual Scintilla
Carburetor	Stromberg NAR-5A.
Fuel consumption at rated power	.58 lbs/BHP/Hr.
Oil consumption at rated power	.025 lbs/BHP/Hr.
Overal diameter	37½ in.
Overall length (without starter)	30⅜ in.



The Model 165 closely follows established Warner practices.

Flying Equipment



New Beechcraft

Model 18S has 13,500-ft. ceiling with Full Load and One Dead Engine

SINGLE engine performance of twin engine ships has been qualified in so many ways that when a manufacturer comes out with a ship that will fly anywhere in the country with full gross weight and one engine dead, we cannot help believing he has something. Such is the claim for the new Model 18S Beechcraft. Its C. A. A. ceiling rating is 12,300 ft. with full gross of 7500 lb. Power plant equipment includes 450 hp. Pratt & Whitney Wasp Jr. engines, Hamilton Standard constant speed propellers, Cambridge fuel analyzer and 210-gal. fuel capacity.

The model 18S Beechcraft introduces a new nacelle and NACA cowling combination and a new tail for Beechcraft twin motors. By means of these improvements it has been possible to secure very satisfactory stalling characteristics. At about seven or eight miles per hour before the airplane stalls, the nose begins to hop up and down a little bit and the control column moves backward and forward slowly through a very small arc which gives the pilot an automatic warning of an approaching stall. Even if he disregards this warning and continues to slow up the airplane until it stalls it does not drop off on either wing and merely noses down fairly slowly and through only a small angle before recovering. At the same time considerably more balance has been added to the elevator and the elevator control has been supplied eliminating a number of pulleys in order to secure easier elevator action.

The height of the vertical tail has been increased thereby increasing both the aspect ratio and the area of the vertical surfaces and more balance has been added to the rudders. The result is that control with one engine dead is practically as easy as with two engines operating. The airplane may be flown hands and feet off with one engine dead and in case of engine failure the ship has almost no tendency to swerve toward the dead engine.

The performance figures on the Model 18S are as follows:

Cruising speed at 11,000 feet and 70% power.....225 mph
Landing speed at sea level.....58 mph
Climb at sea level.....1,800 ft./min.
Take-off distance at sea level....500 ft.
Landing distance at sea level....625 ft.
Single engine ceiling 12,300 ft. (50 ft./min. climb)
Service ceiling.....27,000 ft.
Gross weight.....7,500 lbs.
Empty weight.....5,025 lbs.

Flying Equipment

Rearwin Cloudster

Latest addition to the Rearwin family is the "Cloudster" two-place side-by-side cabin monoplane. Powered with either the 90 or 120 h.p. Ken-Royce engine, the Cloudster is designated as Model 8090 or 8125 respectively. The 90 h.p. model cruises at 110 mph and has a range of 675 mi., while the 120 h.p. plane cruises 125 mph and has a range of 625 miles.

ARADO
Ar 96
ARADO
SCHOOL, TRAINING AND LIGHT FIRST-LINE AIRCRAFT WITH MANY APPLICATIONS. ENGINE: ARGUS AS 10C, 240HP OR ARGUS AS 410, 450HP
ARADO FLUGZEUGWERKE G.M.B.H. POTSDAM-RABELSBERG (GERMANY)

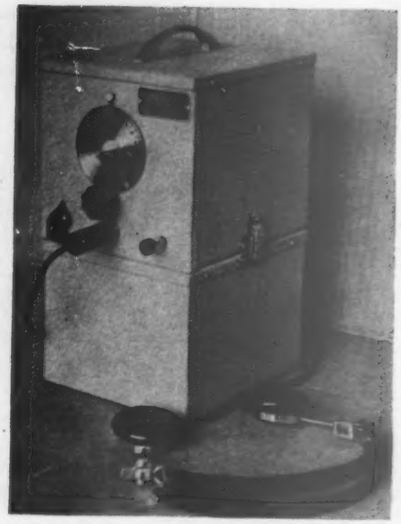
AVIATION — RADIO

Dialing the Air Waves with Don Fink

5-Tube Receiver

Air Radio and Instrument's new outfit has a clip-on battery compartment

UNUSUAL SENSITIVITY considering the size and weight is the achievement claimed for the type AR-AUX beacon receiver recently announced by Air Radio and Instrument Co., Chicago Municipal Airport. Containing five tubes in a superheterodyne circuit (one tube in a tuned r-f circuit), covering the 190 to 410 kc band, and battery operated, the new receiver weighs but 12 pounds, complete with headphones and batteries. The overall dimensions are 11 by 6 by 7 inches. For installation in a small ship, the battery compartment may be separated from the receiver proper and connected by a cable. The list price is $60.



Air Radio's Beacon Receiver with Clip-On Battery Compartment.

Aeronautic Radio

A New Manual for Operators and Pilots by Myron S. Eddy, Published by the Ronald Press

ONE of the first books to devote itself exclusively to the problems of radio applied to aviation is "Aeronautic Radio" by Lieutenant M. S. Eddy, U. S. Navy Retired, instructor in aircraft radio at the Stewart Technical School. According to the preface, the book is intended for all persons interested in any phase of the subject, including students, mechanics, operators, pilots and air transport operation men. The treatment is practical, and the mathematics held to a minimum. The first four chapters are concerned with fundamentals of electricity as applied to radio, including the elements of circuit theory. Following are chapters on radio tubes, batteries and power supply. This information is, of course, available in many other texts, but has been included in order to make the book complete. The remaining nine chapters are concerned directly with equipment used in aeronautical radios, including radio range speakers, telegraph and telephone transmitters, receivers, direction finders, instrument landing systems and radio traffic control. The last three chapters discuss the important problems of the installation and maintenance of aircraft radio equipment. The book contains 502 pages and sells for $4.50.

Aerovoice Airmaster, Model 12-R beacon receiver

Your radio editor can find very little to criticize in the book, except the inevitable fact that no book as general as this can go into detail on all subjects, no matter how interesting they may be to particular readers. If the reader must rely on a single book to obtain his knowledge of radio in aviation, this book certainly seems to be the best available. On the other hand it would seem desirable to consult some other volume, especially devoted to radio (for example, "Principles of Radio," by Keith Henney) which goes into more detail on the matters covered in the first chapters of "Aeronautic Radio."

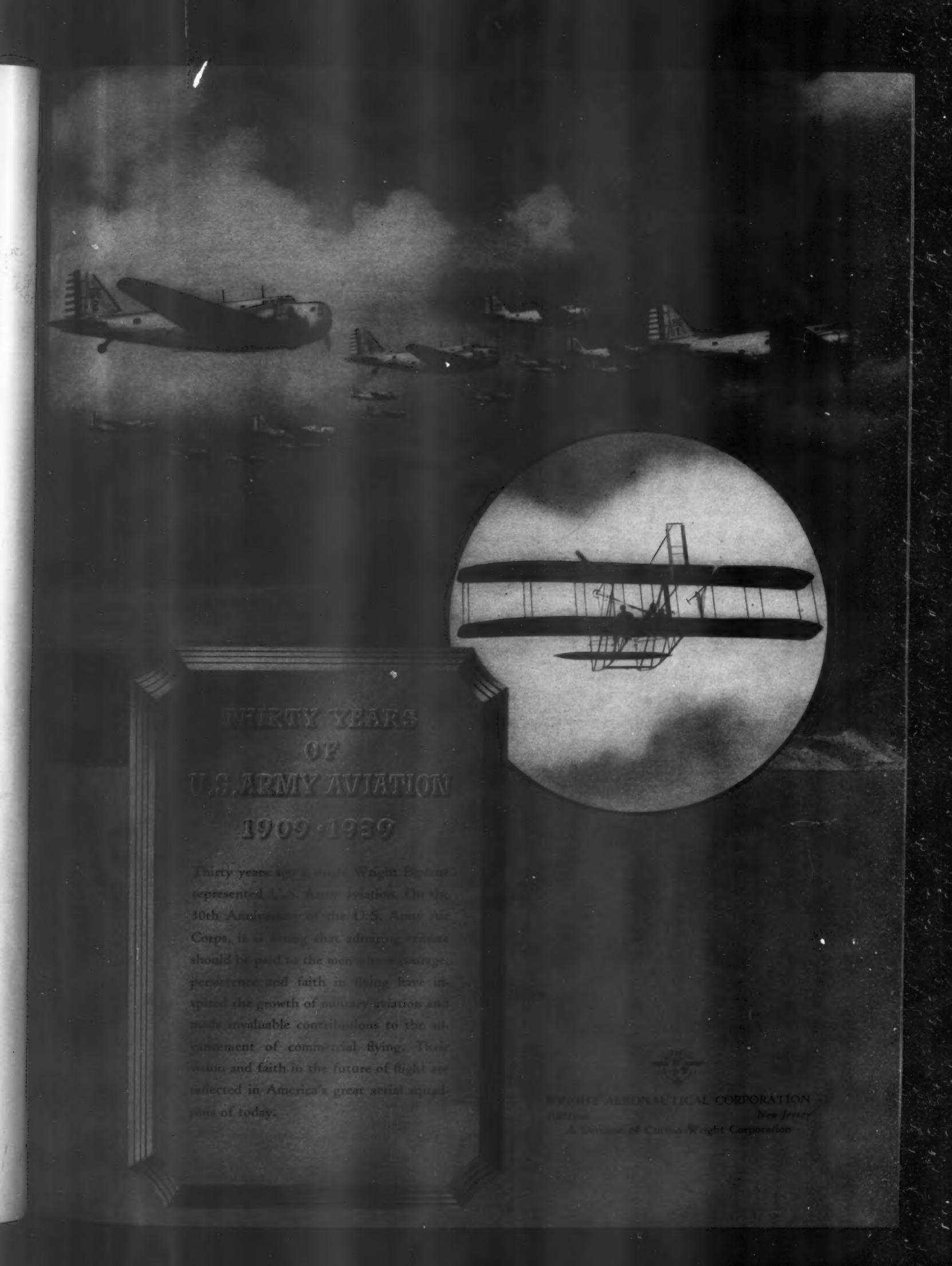
At the end of each chapter there is a series of questions, over 200 in all, of a qualitative nature. Indication is given of the page on which the answers to these questions can be found. Lack of mathematical treatment, which would be serious in a book intended for design engineers, is not detrimental in a book intended primarily for operators who must merely understand the equipment designed by others.

All-Purpose Outfit

Aerovoice send-receive combination weighs but 18 pounds, has 8 watts carrier output

AMONG the present crop of compact light-weight send-receive radio equipments for aircraft, one of the latest to be announced is a neat little outfit made by Aerovoice, Inc. of Islip, Long Island. The transmitter and receiver are available separately, but are built to operate as a unit. The receiver, model R, is designed for dry battery, or 6- or 12-volt storage battery (dynamotor) operation, and covers two frequency ranges from 180 to 420 kc and 2000 to 4500 kc. The controls include a toggle switch for selecting the frequency bands, a volume control, tuning control, phone jack and antenna post. The weight of the receiver, less accessories, is extremely small, 3 pounds, 4 ounces. Equipped with headphones, power supply and cables, the weight is 11 pounds, 12 ounces.

The transmitter, model D-6, is a two-tube crystal-controlled outfit working on any of the itinerant frequencies. The carrier output of 8 watts can be 100 per cent modulated, and the power drain from a 12-volt supply is 4.75 amperes. Its weight less accessories is 3 pounds, 5 ounces. The transmitter comes equipped with anti-noise microphone, crystal, dynamotor, cables, etc. The combination of the type 12-R receiver and D-6 transmitter weighs 18 pounds, including all necessary accessories for 12-volt operation, and costs $205.00.


THIRTY YEARS
OF
U.S. ARMY AVIATION
1909 · 1939
Thirty years ago at Fort Wright Orville represented U.S. Army aviation. On the 30th Anniversary of the U.S. Army Air Corps, it is fitting that admiring tribute should be paid to the men whose courage, perseverance and faith in flying have inspired the growth of military aviation and made invaluable contributions to the advancement of commercial flying. Their vision and faith in the future of flight are reflected in America's great aerial squadrons of today.
WRIGHT AERONAUTICAL CORPORATION
New Jersey
A Division of Curtiss-Wright Corporation

DART DEPENDABILITY

PLUS ITS EASE OF CONTROL
AND ECONOMY OF OPERATION

The DART Fleet at Park's Air College, St. Louis. This outstanding air college uses 5 DARTS in regular daily flight

● What finer recommendation could you ask for a plane than that it combines all the factors for safe, secure, easy operation demanded of a trainer? The fact that the DART is daily increasing in popularity among outstanding flying schools, like the Park's Air College of St. Louis, indicates not only a full measure of airworthiness, but unusual economy as well. The DART uniquely offers speed, comfort, flexibility, and stability . . . features until now only associated with planes in a much higher price range . . . and at remarkably low cost both as to initial price and expense of operation. Two place, 90 h.p.. 110 to 135 m.p.h. Ideal for commercial, sport, or student flying. Send for details.

CULVER AIRCRAFT CORPORATION

Port Columbus

COLUMBUS, OHIO

●

Desirable sales territories available to established domestic or foreign distributors

●

DART...

FIRST SHIP TO GIVE YOU

Big Plane Class at Small Plane Cost

Stress Analysis

(*Continued from page 33*)

ing span distribution and aspect ratio corrections. It is only necessary to determine, once and for all, the curve of chord coefficient against lift coefficient and this same curve can be used to determine the chord coefficient for any station on the wing. It is convenient to obtain the chord coefficient curve directly from the characteristics for infinite aspect ratio, as plotted against C_L in NACA reports. In fact, this process might well be done by the NACA by adding the chord coefficient curve to the infinite aspect ratio chart.

This all means that the usual procedure of converting all wing coefficient curves to the aspect ratio of the wing in question is entirely unnecessary. (Such a procedure is outlined in Civil Aeronautics Authority Manual 04, formerly Aero. Bulletin No. 26.) The only structural use for the aspect ratio correction is in determining the slope of the lift curve for gust load computations, which can be done by a simple equation. Apparently it has taken a long time to realize that the structural engineer and the aerodynamics engineer are interested in entirely different components of the wing forces. The aerodynamicist is mainly concerned with the component in the flight direction (drag) and must therefore make proper allowances for induced angle of attack. But as far as the wing *structure* is concerned, the loads are the same whether they are caused by induced or apparent angle of attack.

Shear Flow

The conception of *shear flow* is relatively recent: in fact there are few text books that deal with it to any extent. Yet we find that practically all stress analyses of modern sheet-metal structures employ this term extensively. A few notes reviewing some of the basic applications of shear flow might therefore be of interest.

In dealing with a structure having a relatively thin shell stiffened by longitudinals (stringers) one of the functions of the shell or skin is to distribute among the longitudinals the axial loads due to bending or direct loading. Another function is to resist torsion. Both of these functions involve the transmission of loads by a process which we designate as *shear*. If we cut open a shell carrying torsion and measure the shear load acting over a unit length of the cut edge of the shell we call this quantity the *shear flow*. (*Running shear* might have been a clearer term.) Obviously the shear stress is obtained by dividing the *flow* by the sheet thickness. Many useful formulas can be derived from the conception of shear flow, particularly if a constant shear flow is assumed. As a practical example, assume that the vertical shear web of Fig. 3 (a) is resisting the shear load S. If a constant shear flow is assumed (as when concentrated flanges take most of the bending loads) the internal shear flow (q) resisting the load S is given by the simple formula:

$$q = \frac{S}{h} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

(*Turn to page 82*)

Rich Monoplane

One of the most interesting, original, and attractive of multi-engine lightplane designs to be announced recently is the Rich twin-engine two place low wing monoplane with pusher engine mounting and tricycle undercarriage. The two 50 hp. Lycoming engines are mounted in nacelles that are supported vertically from the wing. A strut-braced semi-cantilever tail carries twin fins and rudders. Cruising speed with the 50 hp. engines is reported better than 100 mph. Wheels are supported on long-travel shock absorbers but provide added flight efficiency through a two-position arrangement by which the wheels normally remain in a semi-retracted position following take-off, until released for landing, at which time they extend an additional ten inches. Fuselage and engine nacelles are of steel tube construction. The wing is of plywood.

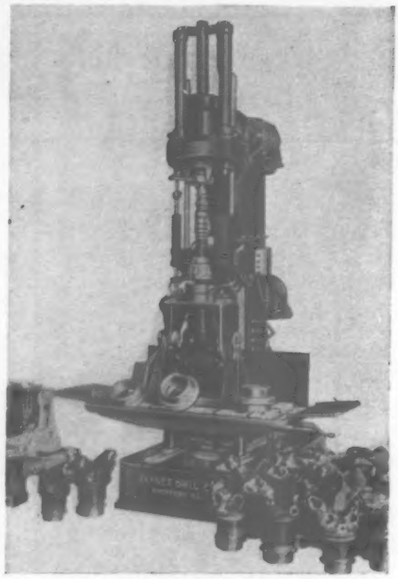
Minx Monoplane

A newcomer to the ultra-light lightplane field is the Minx monoplane developed by the Aircraft Mechanics Association, of San Diego, California. Powered with the Continental A-40 engine the cruising speed is 90 mph, top speed 104 mph, landing speed 36 mph, and range 400 miles. With a span of 24 ft. 6 in., and length of 16 ft., the plane has a gross weight of 700 lbs.

BUYER'S LOG BOOK

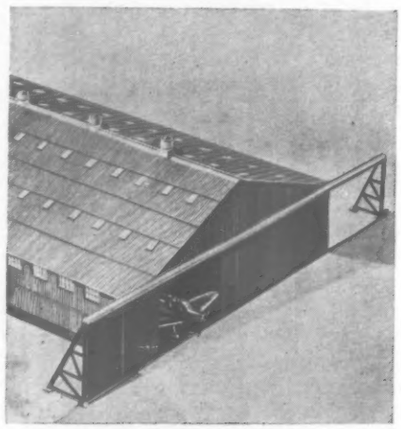
What's New in Accessories, Materials, Supplies, and Equipment

For the reclaiming of aircraft engine cylinders or the honing of new aircraft engine cylinders, the Barnes Drill Co. model 306-H hydraulic Honer, manufactured by the Barnes Drill Co., Rockford, Ill., has been widely adopted by the U. S. Army Air Corps and is also available commercially. The Model 306-H honer is a combined honer and straight line lapping machine and can be used for either type operation instantly. The machine is provided with a positive depth stop for blind hole honing so that the stones cannot be damaged against the cylinder head, yet honing is performed the full length of the cylinder wall. The honing stones may readily be replaced with lapping blocks for a straight line lapping operation. The machine has considerable versatility for either rotations and reciprocations simultaneously, or for reciprocations only with hand or automatic indexing at the end of each cycle of reciprocation.—AVIATION, *August, 1939.*



Barnes Hydraulic Honer

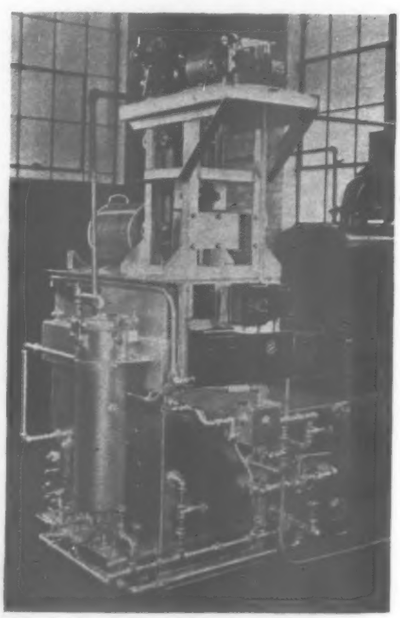
A line of pre-designed steel aircraft hangars is offered by Blaw-Knox Company, Pittsburgh, Penna., through its standard building department. Delivery service of three weeks or less can be obtained. The standard line will include single-span widths up to 100 ft., but larger sizes can be accommodated. Features include extreme weather-tightness, great resistance to corrosion, rugged construction, and quick erection, or dis-assembly for re-erection.—AVIATION, *August, 1939.*



Blaw-Knox Hangar

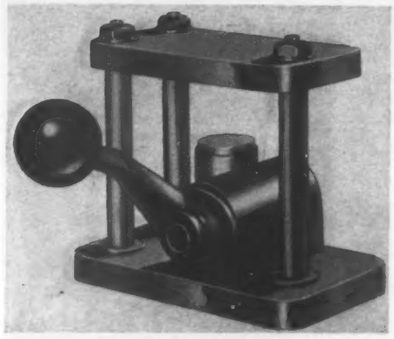
Aircraft manufacturing frequently suffers from excessive tool and jig costs. To alleviate this condition it is sometimes possible to adapt a standard low-cost jig to a variety of machine operations, or for handling a variety of small parts. Such a jig is the Esco "Mijit" pump jig, offered by the Esco Engineering and Sales, Inc., Detroit, Mich. This jig weighs less than six lbs. and has working areas ranging from $1\frac{1}{4}$ x $2\frac{1}{8}$ in. to 3 x 3 in. In operation the Mijit jig provides for special work holders on base, and lower side of top plate. Drill bushings are placed in the top plate when used as a drill jig. Work is clamped in place by operation of the pump arm with its black bakelite handle, and is quickly released through operation of this clamping arm. It is claimed that quicker loading and unloading time are achieved, with lower operator fatigue, and the advantage of using a low-cost standard jig unit.—AVIATION, *August, 1939.*

For cleaning metal parts of such shape that they may trap solvent, chips, abrasive, etc., a special rotating basket degreasing machine has been developed by the Detroit Rex Products Company, Detroit, Michigan. Work comes from the Detrex degreaser clean, warm, and dry, free from any trace of solvent or solvent vapors, chips or abrasive. Careful design has effected material economies in cleaning solvent used. A special automatic elevator mechanism lowers and raises the rotating work baskets with relation to the tank of solvent. A continuous filter is used to keep the boiling chamber free of insoluble material, so that the work is always immersed in clean solvent. The Detrex degreaser is manufactured in various sizes ranging in capacity up to two tons per hour.—AVIATION, *August, 1939.*



Detroit Detrex Degreaser.

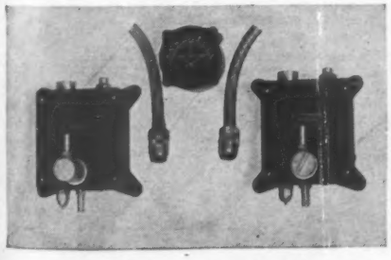
A new low-visibility night landing lighting system has been worked out for airport runways by the Westinghouse Electric & Manufacturing Company, for use in connection with instrument landings. Through use of the new lighting installation it is practicable for pilots to make normal three point landings instead of the high speed approaches which have been used under low visibility conditions. The new Westinghouse system provides three green incandescent lights flush with the ground, which indicate the beginning of the runway. Then, at 100-foot intervals, the amber-color quality of sodium contact lights, spaced on opposite sides, signals that the pilot is over the first 1,000 ft. of the runway. The final 3,000 ft. of the runway is distinguished by white incandescent contact lights and the far end boundary by three more green incandescent lights. Field tests at Akron, Ohio, have shown that the



Esco Mijit Drill jig.

Westinghouse sodium contact lights

Firestone Airtex cushions on Pennsylvania Central Airlines planes.



Breeze Exhaust Gas Analyzer.

sodium contact lights are visible at a distance of 410 ft. when conditions are such that incandescent lights are visible from only 33 ft. All the light from the new contact lights is emitted at an angle of from zero to ten degrees, which is in the direction of the eyes of the pilot in the incoming plane.—AVIATION, *August, 1939.*

Airline passengers may now ride on air in more ways than one, at least when patronizing Pennsylvania Central Airlines, which has just refinished its entire fleet of planes with seats upholstered in Airtex, the new aerated latex product developed by The Firestone Tire and Rubber Company. Airtex has unique advantages which make it ideal for use as a cushioning material on aircraft seats. It is light in weight, compact, and durable. A pneumatic cushioning affect is provided by millions of inter-connected air cells acting as miniature check valves and thus permitting air pocketed within the cushion to compress or escape slowly when pressure is applied; i.e., when a fat man sits down. Upon removal of the fat man, or pressure, the material immediately snaps back to its original form and contour.—AVIATION, *August, 1939.*

To determine the fuel to air ratio of an engine or set of engines in an aircraft in flight an efficient instrument has been announced by the Breeze Corporations, of Newark, N. J. Known as the Breeze Exhaust Gas Analyzer, the instrument consists of a unit (one for each engine) bolted to the firewall, and an indicating instrument mounted in the cockpit. The theory of operation is that electrical resistances show the presence of carbon dioxide, indicating a lean mixture, and hydrogen, indicating a rich mixture. The instrument on the panel shows the pilot when his engine is running at leanest mixture without danger of overheating.—AVIATION, *August, 1939.*

Detergency destroys dirt in the case of a unique cleaning solvent developed by the Curran Corporation, Malden, Mass., for use in cleaning small metal parts. The new dirt deterrent has the high solvent performance of benzine and leaves a light phenolic film which acts as a rust preventative measure. According to the Curran development laboratory the new solvent has a clear sparkling appearance B.D. (before dirt), and is highly penetrating, and inflammable. Small metal parts dunked in the solvent assume a scoured appearance without etching, marking, or loss of weight, and such parts may be rinsed with water to produce a chemically-clean surface where painting or lacquering is to follow.—AVIATION, *August, 1939.*

Cleaning cement floors is a difficult chore under ordinary circumstances, but the job has been simplified greatly by the use of a cleaner developed by the Magnus Chemical Company of Garwood, N. J. Magnus Cement Cleaner is available in two specifications,—92 PR and 92 P. The former is intended for cleanup on old floors or for unusually difficult jobs while the latter is for normal work. Although users report that simple flushing is usually sufficient to remove the grease and dirt after the cleaner has been applied, the manufacturers have developed a 3-purpose brush which incorporates a scraper and squegee in the brush.—AVIATION, *August, 1939.*

Using Magnus Cleaner in the U.A.L. base at Cheyenne, Wyoming

Boeing School trains with heavy planes ranging in size from 2500-pounders to this big Boeing 247D Transport, assigned to the School by United Air Lines.

Boeing School trains its students with heavy planes

Why should a youngster who has spent 1,000 hours in an outboard motor think he is qualified to be captain of the Normandie or Queen Mary? Why should a youngster with 1,000 hours in a light-weight plane think he is qualified to pilot a modern airliner?

Boeing School caters to men who want careers in modern commercial aviation. It, therefore, trains them in the heavier, commercial-type machines. Boeing School trains with 6 different types of planes, ranging from 2500-pounders to the multi-engined transport.

In every other way, too, Boeing School is geared to modern aviation. Students assemble and build everything from modern radio equipment to completed planes in the school's 17 modern shops and laboratories. Boeing students "go to school" right on United's great West Coast terminus, the 890-acre Oakland, California, Airport. They study among the men and the fleets of the most experienced division of modern aviation (United Air Lines). They meet and know the type of career men whom they are going to join—watch them using the equipment they are going to use.

BOEING SCHOOL GRADS MAKE GOOD!

• Send the coupon below for the new Boeing School bulletin and see the facilities that are open to you here. 11 career courses—54 subjects. Let sending the coupon be your first step toward an aviation career.

Boeing School of Aeronautics

UNITED AIR LINES — A DIVISION OF UNITED AIR LINES

ENROLLMENT PERIODS: JANUARY, APRIL, JULY, OCTOBER

11 CAREER COURSES One specially designed to fit your chosen field of aviation. Check the course or courses you are most interested in:

Courses requiring High School only

- ☐ Airline Pilot and Engineering
- ☐ Airline Operations and Engineering
- ☐ Airline Mechanic and Operations
- ☐ Commercial Pilot and Operations
- ☐ Airline Mechanic
- ☐ Aircraft Sheet Metal
- ☐ Private (or) Solo Pilot
- ☐ Limited Commercial Pilot

Courses requiring 2 yrs. of college

- ☐ Air Transport Engineering

Courses for engineering graduates only

- ☐ Airline Technician
- ☐ Airline Meteorology

Courses requiring special training

- ☐ Special Airline Pilot
- ☐ Instrument Rating

NOTE: Link trainer and modern multi-motor instruction available to students in all courses.

Boeing School of Aeronautics
1089, Hangar No. 5
Airport, Oakland, California

GENTLEMEN: Please mail me—without charge—the 1939 Boeing School descriptive booklet containing complete information on the school and describing in detail the courses I have checked at the left.

BOEING SCHOOL OF AERONAUTICS

Name.....

Street Address.....

City.....

State.....*Age*.....

Previous Schooling.....

THE AVIATION NEWS

REVIEW, COMMENT, FORECAST

DANIEL SAYRE
C. F. McReynolds, *Pacific Coast*
Blaine Stubblefield, *Washington*
E. R. Lockin, *New York*

AUGUST 1939

Turner Picked to Repeat in Thompson

(Story on page 52)

THE ATLANTIC BOWS DOWN: Pan American Airways' first crossing of the Atlantic with air mail June 20 started something. Since that time Pan American Clippers have finished more than a dozen round-trips. American Export's "Transatlantic" made two round-trip surveys. Air France made two survey trips and opened a mail service. Archbold's Guba crossed Dakar-Virgin Islands-New York. A Consolidated bomber was flight-delivered to England.

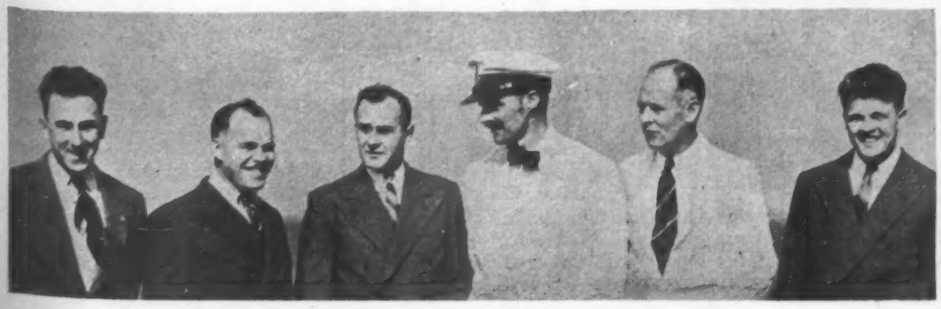
Above—The crew of the Dixie Clipper which made the first commercial passenger crossing June 28: Capt. R. O. D. Sullivan, Capt. G. B. Blackmore, R. B. Fordyce, B. S. Harrell, J. N. Gentry, B. Canodotti, J. Salnini, H. G. Lambert, H. L. Drake.

Right—Durston Richardson and Thomas Jones welcome the crew of the Transatlantic back to Floyd Bennett Field. On the hull: R. B. Carlson, W. W. Ehmer and C. G. Doyle. In the hatch: T. S. Terrill and C. F. McDonough. On the step: Capt. Pat J. Byrne

Wide World

Below—The crew of the Guba. Left to right: G. D. Brown, R. Rogers, R. Booth, Richard Archbold, L. A. Yancey, S. Barrinka.

Rudy Arnold Photo



NATIONAL AVIATION

A Look At The Races

Fuller, Chester and Turner look good from here

Making forecasts about the National Air Races to take place this year Sept. 2, 3, and 4, from any such date as July 18, upon which this is written, is as much of a gamble as trying to pick the winner of the Kentucky Derby in a Winter book. But there is a lot of pre-race dope already floating around which does seems deserving of circulation here.

We listed chief details of the distribution of the $85,000 prize list in our May issue. There is considerable possibility that this list will be upped materially before opening day. Aside from the prize list, this year's races will differ from previous ones in a few minor details. Bendix ships, for instance, must be fully equipped for instrument flying and the pilot must hold an instrument rating. Qualifying speeds will be 220 mph. for the Greve race and 240 mph. for the Thompson. Qualifications for the closed course events must be run off between Monday, August 28, and the evening of Friday, Sept. 1. A new regulation that should please everyone is that no ship may be testhopped for the first time after August 27. This should eliminate much of that hectic last minute construction work in evidence during past years. The Contest Committee has also made some new regulations as to the numbering and marking of ships and has recommended contrasting color combinations to help spectators identify the contestants during the races.

In the Bendix, Frank Fuller is reported to have been preparing himself and his plane for a repetition of his 1937 victory. Jacqueline Cochran has had the Seversky racer (in which she won last year) fitted with a new center-section embodying a fully retractable landing gear. That plus some minor engine changes should add 25 to 40 mph. to her top speed. Miss Cochran, however, has not definitely announced that she will enter the Bendix, although she is definitely booked for an attack on a number of speed records. Just to warm up while her big ship was getting finishing touches at the Seversky plant she went out last month and put a 145 hp. Monocoupe over a 100 kilometer course at Floyd Bennett Field to set a new woman's mark of 163 miles an hour. In any case Inez Gibson will represent the "weaker" sex in the Bendix. She has been reported in special training for the event during the past several months under the guidance of Max Constant.

The Greve, as usual, sizes up as the competitive gem. Art Chester and Tony LeVier are primed to hound each other for two hundred miles as they did last year. Chester, one of the real racing motor experts of the country, has done a prodigious amount of work on his ship and may even up with LeVier who nipped him in a hair-raising finish last year. The new Folkerts is ready, with Del Bush, a newcomer to the Nationals, scheduled to take the controls. Several others 549s will be in there to make the going tough. Certainly LeVier's new record of 1938 will go.

Turner looks like the man to beat in the Thompson. The Colonel claims an added 25 mph. for his record-breaking ship through motor changes. That puts him over the 300 mph. mark for the distance. If he is right and makes it he will be very, very hard to beat. But there will be plenty of competition crowding him all the way and nobody knows that better than Turner himself.

WELL-EARNED: Major Lester Gardner presents the Musick Memorial Trophy, posted by Aukland, N. Z., for contributions to the safety of ocean flying, to Arthur Gouge, designer of the Empire boats.

Guba Home

Archbold expedition ends brilliant circling of globe.

One of the most remarkable flights in aviation history, and incidentally one of the least adequately publicized, ended July 6, as the big Consolidated flying boat Guba, bearing the Archbold New Guinea expedition of the American Museum of Natural History landed at San Diego. June 3, 1938, it had headed across the Pacific to Honolulu. Thence two non-stop flights carried it to Wake Island and Hollandia in Dutch, New Guinea, a distance of some 7,224 miles. For almost a year the Guba transported supplies from Hollandia to various scientific ground parties in the mountainous interior of that island. Thousands of plant specimens, birds and mammals were collected, many of them new. A number of villages with entire populations which had never before seen white men were visited and studied. Thousands of miles of unknown territory were investigated and mapped. A direct return homeward by the outward route after such successes would have been enough for most expeditions. Not for this one.

This spring the crew of the Guba (see page 51) flew to nearby Australia. Then, chartered by the Australian government to survey an alternate route to England via the Indian Ocean and Central Africa, it took off on another adventure.

Accompanied by a Captain Taylor as a representative of the Australian government, the ship made its leisurely way across the Indian Ocean. Setting out during the first week in May it called at Batavia, flew over Christmas Island, stopped at Cocos Island, hopped to the Chagos group, then pushed on to Mahé, principal island of the Seychelles group approximately 1,000 miles from the east coast of Africa. June 21, it arrived at Mombassa, Kenya Colony, East Africa. By this time it had crossed 9,820 miles of open ocean since leaving Sydney. June 27, the plane arrived at Dakar on the west coast of Africa. A few days later it struck out over a new route, crossing to the Virgin Islands in the Caribbean. July 2, the crew was home in New York for an elaborate reception at the New York World's Fair. In all, the expedition had completed some 700 hours of the sheerest type of pioneering flight without a single serious untoward incident.

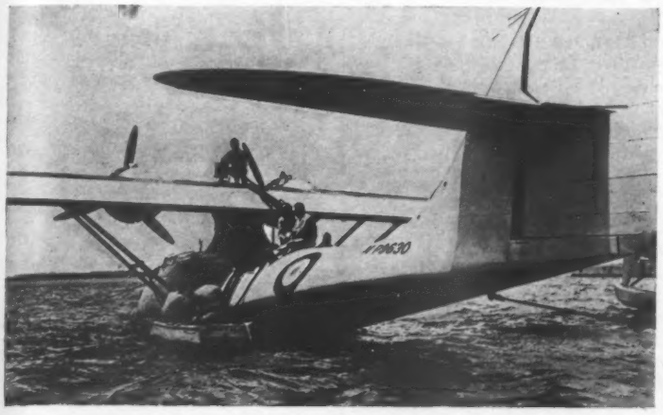
Flyaway Factory

Consolidated makes first trans-Atlantic delivery

Twenty-two years ago, a lot of high-pitched crowing was going on in this country about (1) How many tens of thousands of combat planes the U. S. was about to build and deliver to Europe. (2) How the biggest of these were going to be delivered by flying them across the Atlantic. Cynics on the subject of war-time propaganda as dished out for home consumption may therefore relish the facts that (1) The U. S. has already this year delivered more combat planes to England and France than it did during the entire war period. (2) That just last month the first military aircraft ever to be delivered by air across the Atlantic arrived in England.

Not that the delivery on July 14, of the Royal Air Force's new fifteen-ton Consolidated patrol-bomber was not a brilliant enough feat of airmanship. The crew was no amateur one. Russel Rogers was pilot; Lewis A. Yancey, navigator and relief pilot; Raymond

Booth, radio man; and Gerald Brown, engineer. All of them were just returned from the brilliant Archbold round-the-world flight described in another column. First plans were to make the first stop out of San Diego at Botwood, Newfoundland, but the first leg of tne trip, which started July 10, was ended at Buffalo after the ship had run into severe headwind conditions while crossing the Middle West. The next day, the big ship pushed on toward Botwood. The day after that with no more fanfare than as if they were ferrying their big Consolidated across San Francisco Bay, Rogers and his crew crossed over to land at Felixstowe, England.



DELIVERY SERVICE PLUS: The R.A.F.'s new Consolidated pauses at Buffalo.

United Would Buy W.A.E. Merger up to C.A.A.

Efforts of the United Air Lines and Western Air Express to weld their respective services into a coordinated smooth-functioning unit reached a new high last month as permission was sought from the C. A. A. for United actually to purchase the majority of the capital stock of Western Air Express. For the past two years the two lines have sought, first from the Post Office then from the C. A. A. to set up a system for the mutual leasing of equipment along the railroad patterns. The Post Office ruled adversely on that petition. So far the C. A. A. had made no determination on it.

Details of the proposed deal are most interesting. As closely as can be determined by anyone outside the transaction, the plan for the sale seems to have originated with a group owning the majority of stock in Western Air Express and which included Alfred Frank of Salt Lake City, the Boettcher-Newton interests of Denver and William A. Coulter of Philadelphia. The price agreed upon was an exchange of one share of Western Air Express stock for one-third of a share of United stock, or, at the option of the holder, for one-sixth share of United stock plus $1.66 in cash. President Patterson of United announced that once the Security and Exchange Commission and the C. A. A. approved the deal, all stockholders of Western Air Express would be given an opportunity to trade their shares on the same basis.

From an air transport view, such a merger would seem very logical. There are a large number of air travelers from Los Angeles moving to points served solely by United Air Lines who have in the past used Western Air Express as far as Salt Lake City. Especially on schedules making connections at Salt Lake City necessary between midnight and breakfast time, the plane-change there is very inconvenient for them. Such a union would also of course give United a direct entrance into Los Angeles and a more favorable setup for competing with American Airlines and T. W. A. for business in the Los Angeles region. Authorization to render service to both San Francisco and Los Angeles is, after all, nothing more than T. W. A. has held for some time.

Yet announcement of the proposed deal was immediately met by storm of protest from Senator O'Mahoney, Senator McCarrran and Senator Wheeler on the general charges that such a merger would be monopolistic, that it was backed principally by New York bankers and that it would lead to neglecting service to intermediate communities.

Fate of the merger is of course in the laps of the members of the Civil Aeronautics Authority.

THE WASHINGTON WINDSOCK

by BLAINE STUBBLEFIELD

Negotiated procurement may be negotiated

A ripping power dive by manufacturers in full formation brought quick death to Senator Lister Hill's catch-all bill which included an innocent suggestion that the Government set up an "aircraft engineering center"—one of those yardstick things. Said the Kitty Hawk heirs, "You can audit our books and limit our profits but you don't pay taxes or rent and you don't have strikes and your yardstick might not be 36 inches long. Nix on it."

Negotiated airplane procurement is ably defended by the War Department in its appeal to Congress for authority to side-step the bidding system. The bulk of orders go to three or four companies because little ones can't afford to build sample jobs. Sometimes, too, a big firm builds a sample, aviation moves fast, somebody else guarantees better performance on paper, the Department calls for a competition in which the first builder may lose out. Aim of the President and WD is to give "educational orders" to the entire industry. But when Asst. Sec. Louis Johnson talked "emergency," calm congressmen asked "What emergency?" And Congress feared to let the agencies negotiate. Negotiation is like a cash register that doesn't register. The social register of the industry, 25 strong, met with Mr. Johnson.

Ad space for seat space was re-authorized by CAA, after the new law stopped it, permitting operators to continue barter agreements with newspapers through fiscal 1940. Presumably that will end it. Idea is to cushion the transition of firms with small capital from an IOU paper basis to cash basis. It's reported here that airlines are swapping seats for parts, tires, gas. If so, CAA might notice, or might look the other way.

Air progress week will be *two* weeks, Sept. 11–24, sponsored by National Aeronautic Association with Army, Navy and most aviation groups and federal agencies participating. A publicity committee of Washington aviation writers and representatives is cooking up a campaign to sell flying on a bigger scale. Might ring the bell; watch it.

Joe College Aloft is a great success. Experimental part of the training program is completed. Regular program was authorized by Congress: $5,675,000 for fiscal 1940, additional years limited to $7,000,000, to train 15,000 and 20,000 respectively. Money is in the third and last deficiency bill. Aside from defense benefits, good effect already visible in small airplane sales and impressive increase in fixed base business. Hope it will stimulate schedule traffic.

Spare Parts: 400 entries received in the Air Corps-Liberty song contest, most lousy, some fair, about 10 promising; whether they've got an Anchors Aweigh or Caissons depends on whether lads sing it. . . . Reorganization of CAA soft-pads among the Corinthian columns like a Sioux in pine timber; maybe just our nerves. . . . Aviation, invented by yankees, will be told in mural on a 9 by 300 circular strip high in Capitol dome if Congress passes resolution; $20,000 appropriated long ago. . . . Hinckley told the University of Virigina aviation will grow more by 1950 than it has since Lindbergh's flight; probably right but don't tell Wall Street. . . . Who or whom did Oswald Ryan mean when he cracked at airway monopoly; must have been United-Western Air; United says combination would improve competitive situation among transcontinentals.

Why "just get by" with a makeshift bench when you can have a "HALLOWELL" STEEL WORK-BENCH at so little cost?

Pat'd and Pats. Pending

Fig. 732—"Hallowell" Steel Work-Bench. Drawer is extra.

"Hallowell" Benches have these 3 big features needed for Aviation Production and Maintenance Work.

1—SMOOTH WORKING SURFACE

"Hallowell" Bench Tops are one piece of sturdy steel, perfectly flush . . . and they stay smooth . . . can't get oil soaked . . . won't splinter or split.

2—LASTING RIGIDITY

Flanged steel leg construction assures permanent rigidity with a steady working surface.

3—EASY MOVABILITY

Whenever changed requirements demand, "Hallowell" Benches can be taken apart, moved to a new location and set up again firm as ever. So unlike the kindling wood that results when you try to move a wooden bench. Two or any number of "Hallowell" Benches can be joined end to end to provide a continuous smooth working surface.

—TWO OF THE 1367 COMBINATIONS AVAILABLE

Pat'd and Pats. Pending

Fig. 936 — "Hallowell" Steel Work Table with a beautiful top of laminated wood. Just the table for fine work.

Pat'd and Pats. Pending

Fig. 923 — "Hallowell" Steel Work-Bench with laminated plank in front. For Die Sinkers, Tool Makers, etc.

Send now for the catalog that tells about the complete line.

STANDARD PRESSED STEEL CO.

BRANCHES: BOSTON, DETROIT, INDIANAPOLIS

JENKINTOWN, PENNA.

BOX 566

BRANCHES: CHICAGO, ST. LOUIS, SAN FRANCISCO

DEFENSE

Congress Comes Through

By Blaine Stubblefield

The Seventy-sixth Congress flew the spirit of '76 to the ceiling. This country and the world moved its air forces way out in front as first line weapons. The nervous nations put near $20,000,000,000, mostly IOMyself paper, into their war pots for 1940! This ten-wheeled figure included $2,000,000,000 worth of Roosevelt money for defense of home and hemisphere. And aviation, including civil and military flying tackle with all appurtenances thereto, got nearly $700,000,000, or 35 per cent of the total chest.

Three aviation projects are being financed in the third deficiency bill — a congressional device for paying off agencies that run short of change or get left in the appropriations rush: (1) the CAA pilot training program costing $5,675,000 this year; (2) about one million dollars for mail pay by the Post office on new domestic routes, and $1,419,520 for foreign mail pay, which amount was increased from $995,680 because transatlantic service got started the first of the fiscal year instead of later, as expected; (3) $10,000,000 for the NACA sunnyvale research laboratory.

As this is written a bill seemed destined for passage, authorizing the Secretary of War to dispense with the "cumbersome process" of competitive bidding on construction projects outside the United States. It was aimed primarily to speed coast works and anti-aircraft defense at the Panama Canal, for which $23,750,000 was authorized under the expansion act. The work would be done by contractors on a cost-plus-fixed-fee basis, with profits limited to ten per cent. Of course the law, if passed would apply to all off-shore air and other bases, and would run into big money especially in connection with the proposed Puerto Rico gibraltar, which will include air operations.

Washington assumed that the Army was talking about its new streamlined air-cooled engines primarily when it announced the beginning of a fleet of super fighting ships better than those of any foreign powers. Some contracts had already been let, using them in small, speedy single-seaters, and orders for bombers and heavier equipment would follow. Within about two and a half years, Army and Navy expect to have on the line most of the 9000 planes now authorized; not *less* than 3000 for Navy and *not more* than 6000 for Army.

Washington Conference

War Dept. talks contract system with industry

War Department and Air Corps officers met officials of twenty-two of America's leading airplane and aircraft factories in Washington on July 10, to discuss problems which had risen in connection with the Air Corps expansion period. After the conference, Louis Johnson, Assistant Secretary of War, reported that many minor difficulties had been readily settled at the meeting and that he was more assured than ever that the industry would be able to meet the demands of the program. No further details of the conference were made public but it is generally understood that considerable discussion took place of suggestions to permit the War Department to place aircraft contracts without competitive bidding. Such permission, it is thought, would help speed the whole program and render it much easier for the War Department to take advantage of the facilities of the smaller manufacturers. Congressman Andrew M. May, Chairman of the House Military Affairs Committee, meanwhile introduced a bill permitting such contracts.

Bill for Pilots' Pool Becomes Law

C.A.A. to train 95,000 in five years

The bill authorizing the C.A.A.'s program to train civilian pilots was signed June 27, by President Roosevelt at Hyde Park, N. Y.

In its final form the bill provides for the training of 15,000 pilots in the next twelve months and authorizes a $5,675,000 appropriation for the purpose. It authorizes an additional $7,000,000 appropriation annually until mid-1944 for the training of another 20,000 aviators each year.

Between 300 and 400 universities and colleges are ready to offer the introductory "ground school" course when the next scholastic year begins in September.

over 500

CURTISS PURSUIT AIRPLANES *of the* P-36 TYPE

Since originally developing the design, Curtiss has built more than 500 airplanes of the P-36 type, which is now used as the standard pursuit plane of the U. S. Army Air Corps.

It is with extreme pride that this announcement is made as the operation of this airplane by many air forces throughout the world marks Curtiss as the foremost builder of pursuit aircraft.

The major portion of production work on these modern Curtiss planes has been done during 1939 and Curtiss factory facilities are geared to continue the manufacture of many additional units.

Planes of the P-36 type are extremely fast and maneuverable and may be equipped with various combinations of armament to make them unusually effective offensive or defensive units of modern aerial warfare.

CURTISS AEROPLANE DIVISION
CURTISS-WRIGHT CORPORATION
Buffalo *New York*

Curtiss CONGRATULATES The U.S. ARMY AIR CORPS

AVIATION ABROAD

Merger Emerges

Combine to be called "British Overseas Airways"

The big British transport merger is just about here, for the Air Ministry has published a bill putting it into effect which ought to go through Parliament without much trouble. The Imperial and British Airways stockholders have accepted the fairly generous prices offered by the government for their stock, so financial details are pretty well cleared away. The name of the new company is quite a mouthful—British Overseas Airways Corp.—but the Britishers hope it will be cut down to something more snappy as time goes on.

Item one in what was wrong with British airlines was lack of capital to carry out all the expansion schemes that were thought necessary to give Britain her proper place in the air. This is taken care of by authorization of £10,000,000 capital stock (Imperial felt pretty bloated when it boosted its limit to £5,000,000 this year) on which a moderate fixed dividend will be guaranteed by the government. This ought to make raising money easy and at the same time eliminate the old Imperial custom of paying good dividends even at the cost of the services. About £3,000,000 will come out of the till at the start to buy the two present lines.

Now that the government is sure how much will go to dividends, they will ladle out subsidies a lot more generously and on a longer range basis than before, which ought to make for better planning. Until March 1941 subsidies will be paid on the basis of covering losses on existing and new routes. From then until 1953, subsidies will be set every three years up to a maximum of £4,000,000 a year, less the £100,000 a year earmarked for internal lines until 1943. This compares with the £535,000 received in 1938, and the £3,000,000 a year limit recently set after the Cadman Committee recommended doubling the previous limit. There will be some sort of profit-sharing agreement written in the route contracts, as has been done in the past, to keep the new company on its toes promoting efficiency and also to give the Treasury a break. As was the case in the original agreement with Imperial, the new company will not have a monopoly on flying rights, but will have one on all subsidies for overseas services.

The government will keep a hand on the throttle by appointing the entire Board of Directors, but from then on they are on their own to run the company. They should be off to a good start if they can work out a merger of the experience and technique of the two lines. Imperial has flown a lot of miles to a lot of strange places and done some fine pioneering, but British Airways has generally had more on the ball in equipment, operations, and maintenance methods. They pretty much had to or they would have starved to death in their unsubsidized days.

It will probably take until October or so to get the bill through the Parliamentary mill and set up the new company. When this is finished you can get ready to see the British start full out on a campaign of expansion and improvement that isn't going to stop for a long time.

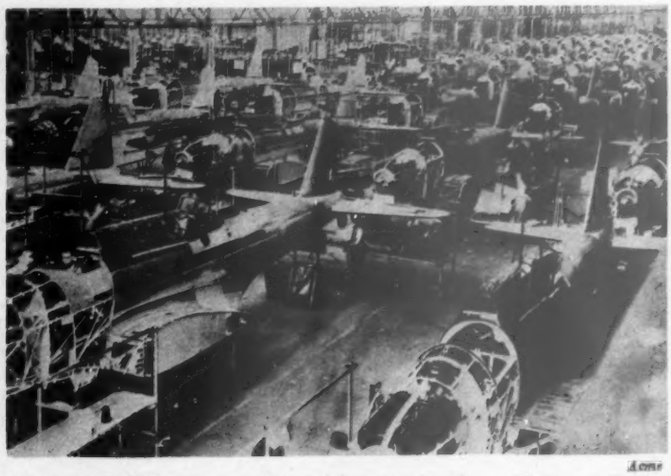
One requirement for this expansion is some airplanes, and the committee set up by the Air Ministry last spring to study the problem of civil aircraft production has brought in its findings. It recommends that old British remedy—a small but active Civil Aviation Development Committee to include representatives of manufacturers and operators, not inside the Air Ministry but with power to make a big noise in Air Ministry affairs. All operators would bring their requirements and ideas to this committee, which would decide on what types should be built and where, remembering the export market.

Chief general conclusion drawn is that for a long time to come the small market for transport airplanes in the Empire will make government assistance necessary in developing them. Some help might come if the R.A.F. bought big quantities of airliners for transports, but it was pointed out that the only way this could be made to work would be for the R.A.F. to be satisfied with the kind of a ship the transport operators want without demanding a lot of modifications. The present system of having the Air Ministry draw up specifications for airliners and order prototypes was strongly condemned because it has a way of producing ships that don't really meet the operator's requirements, and at the same time the usual accumulation of red tape around anything the Air Ministry orders piles up delay. More concentration on safety research both in design and operation was also advised.

The report sounds fine as far as getting the most for the least

Wide World

THE POLES—are not without planes. Above, a squadron of PZL bombers lines up for inspection outside Warsaw.



Acme

THE BRITISH—are really getting production. Above, a flock of Fairey Battles moves through the Austin Works at Birmingham.

Preyer

THE DUTCH—whose air force is just 25 years old, have built up real air strength in the East Indies—preponderantly Martin.

time and money goes, but the committee didn't bring in the answer to the situation that has tied civil production up most—the armament rush. Until this is worked out none of the other suggestions are really going to build many airplanes.

KLM Promotes Veenendaal

KLM has appointed Henri Veenendaal to succeed the late Peter Guilonard as General Technical Leader of the KLM organization. A native Hollander, Veenendaal entered KLM's technical service in 1921. He is well known in this country, having visited here in 1931 to supervise delivery of KLM's first order for American engines — Pratt & Whitney Wasps. In 1935 he was again on this side, in his capacity of General Technical Representative for the United States, and handled the delivery of the company's order for 43 Douglases and 12 Lockheeds.

England, France Get Better Production

Expansion of the shadow factory scheme is still going on in England to add to the sixteen airplane and engine plants already finished or under construction. Eleven of them are up to full production and another is not far from it. Now there are announcements of a $20,000,000 engine plant managed by Rolls-Royce to be rushed up near Glasgow, and also of three new plants near Coventry. One story has it that these last will turn out ships exclusively for the French, a plan supposed to have been agreed on during General Gamelin's visit to England.

The French are doing a few things on their own hook too. Production is supposed to be six months ahead of schedule, which doesn't mean much, but in actual figures it's running around 150 to 200 a month. This looks puny compared with the big numbers being talked in most first-class powers, but it's about four times better than it was six months ago. The latest recruit is said to be the French Ford Co. This dope has it that the new Ford plant near Paris will turn out Rolls-Royce engines under license, and even that a trainer powered with a Ford V-8 engine is to be produced.

There are still some headaches left from the days of nationalization, as the government has a lot of lawsuits on its hands brought by the original owners of the aircraft factories over the price at which they were bought out. So far the government has laid out 303,000,000 francs to the old owners, 280,000,000 francs for new equipment and tooling up, and 236,400,000 francs to keep the plants going. Government and private capital still aren't being pumped into the industry fast enough to satisfy the Air Ministry. To help out the situation, the French Bridge Federation has sprung to the defense of the Republic by requesting all bridge players to give 10% of their winnings to buy a ship and present it to the air force.

End of a Mystery

The official explanation of how a German seaplane came to be picked up by a steamer in the middle of the South Atlantic last March is now out. The first story was that it was one of the regular Lufthansa mail planes. When that didn't check, the next dope was that it was the Do 26 boat off on some kind of a special flight, but pictures taken by a passenger on the steamer showed it wasn't. The Germans finally gave out that it was a record attempt that hadn't worked and let it go at that. Now it is learned that the ship was a Heinkel 115 twin float torpedo bomber with two BMW engines. It normally grosses around ten tons, but the Germans figured that if it could get off overloaded to around 17 tons it would have a range well over 6,000 miles. This would be plenty to take the record away from the piggyback Mercury. The ship got off the Baltic at Ribnitz without assistance but after 4,700 miles one motor let down, and in the usual German fashion the attempt was hushed up and so turned into a minor mystery.

Dr. Adolf Rohrbach

Germany's veteran plane designer, Dr. Adolf Rohrbach, died at Kampen on July 9, at the age of 51. During the war and until 1920, he was chief constructor at the Zeppelin airplane works, during which time he produced the 1,000 hp., all-metal Staaken transport. In 1920, however, the plane was ordered destroyed by the Inter-allied Aeronautical Commission in compliance with the Versailles Treaty. As a result, Dr. Rohrbach established his own plant in Denmark. Licenses to construct and plans for his Rohrbach-Ro II were bought by Great Britain and Japan. After 1927 Rohrbach concentrated on Rohrbach-Romar transports for Lufthansa.

AS OTHERS FLY IT

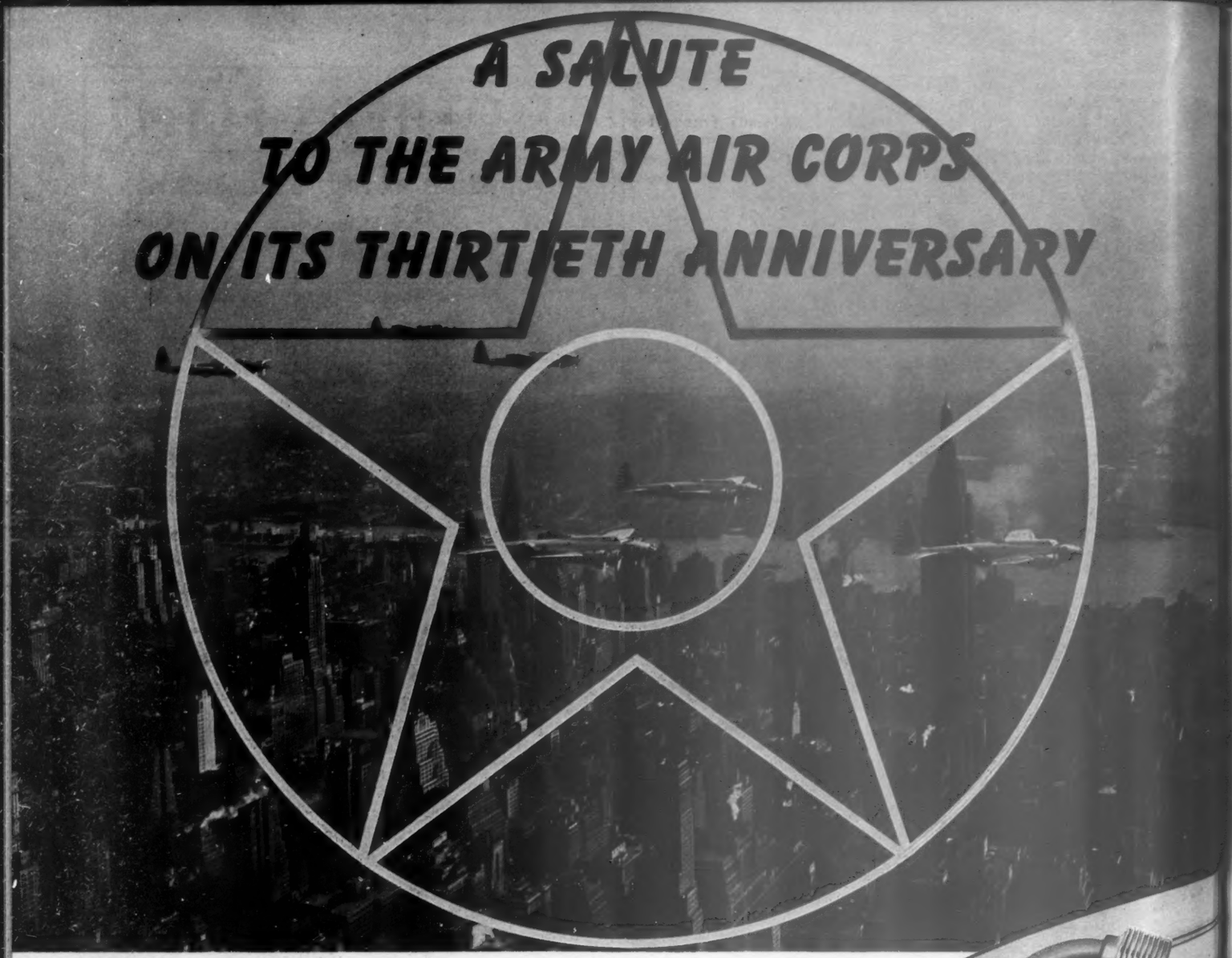
Wright Cyclones put Ensigns back in service

Cheering over the return of the Ensigns to service with Imperial was dampened for a few super buy-Britishers by the announcement that some of the Ensigns would be powered by Wright Cyclones. Over European routes the 800 feet-per-minute sea-level climb and 900 foot take-off run (squeezed out by boosting the take-off power of the four Tiger engines to 935 hp. and installing constant speed props) are good enough, but a lot more reserve power was needed in the ships to be used on the England-India run. The British evidently didn't want to run the risk of another slip by counting on the big Bristol Hercules sleeve valve, which hasn't yet had any extensive tests in service. How far things have come from last year's general frothing at the mouth and writing of indignant letters to the Times over purchases of military ships in the U. S. is shown by the reaction to the Ensign-Cyclone news. There were few squeals, and the hardest cracks taken at the Air Ministry were over their failure to do it earlier so that the ships could have been out and flying by now.

Here are some official German performance figures on military ships released for export—interesting because these types make up a good part of their air force and also because a lot higher figures have been in circulation. The Dornier Do 17 bomber with 1050 hp. DB600G engines is credited with a maximum speed of 298 mph. and a range of 770 miles with 2,200 pounds of bombs. The Heinkel He III bomber with 1070 hp. DB601A engines has a top of 261 mph. and carries the same bomb load 2,110 miles. As for fighters, both the Messerschmitt Me 109 and Heinkel He 112 are rated to do 354 mph. when fitted with DB601 engines. Don't forget that the latest models supplied to the German Air Force have been cleaned up in a few details and probably have some more power—around 1200 hp.—and also that the most recent ships just coming out aren't on the list.

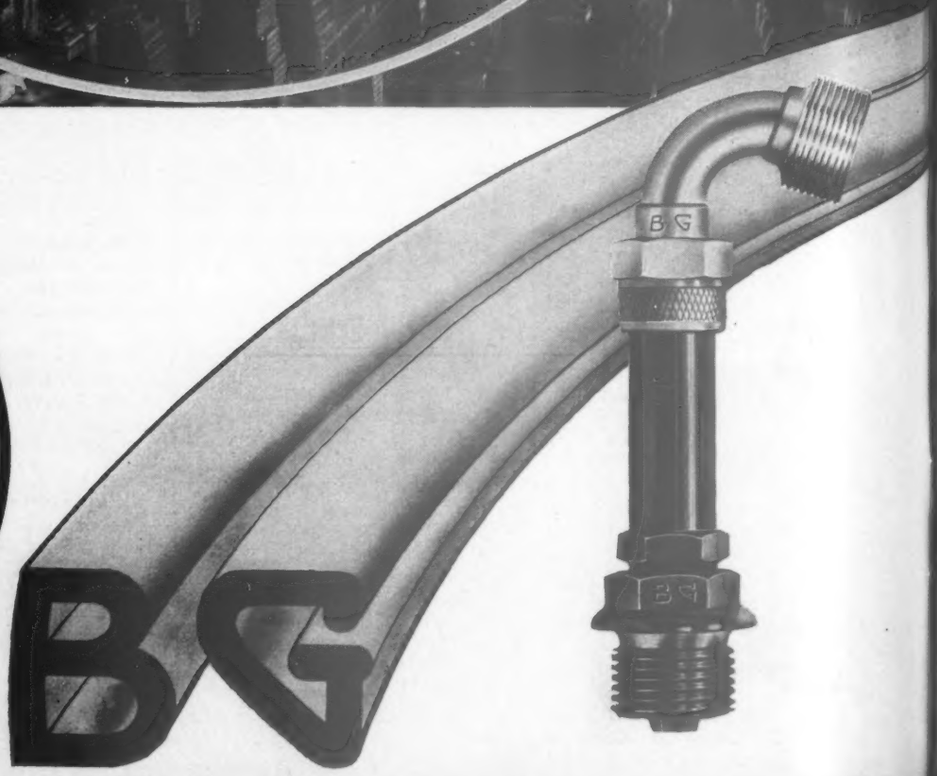
The French are stepping out this summer with an Every-Hour-on-the-Hour service between Paris and London from 9 AM to 7 PM weekdays except Wednesday and Thursday. This gives them eleven flights each way against eight for the combined British lines. Competition on this run has been hot lately—the French came in with their new Bloch 220's last year and took the big share of the business, getting up to where they did about as much as the two British lines combined. The British counted on the Ensigns to even things up, and when these had to be pulled off the line, fell back on the Frobishers. These have had their troubles too, mostly with involuntary folding of the landing gear on the ground, but Imperial's figures began to draw up on the French until finally over the Whitsun holidays (seventh week-end after Easter to you) one of the annual traffic peaks, they pulled out ahead by a nose. Now the French are going to come back strong with increased schedules and the battle will be on again.

British aircraft manufacturers will be hit by the tax on excess armament profits proposed by the government and likely to be passed before long. There's been more and more hollering from the Labor side of the house over 25% dividends when everyone was supposed to be doing his bit in the emergency, and finally the Gov't had to do something about it. There has also been talk that the Air Ministry was taking a licking on its procurement system of getting in a corner with the manufacturer and agreeing on a price, but for the time being nothing will be changed along this line. The excess profits scheme is complicated enough to keep the tax experts busy figuring out just what it means, but the basis is that the tax collector will try to take a 60 per cent cut of all profit made on armament orders.



FFICIAL PHOTOGRAPH, U. S. ARMY AIR CORPS

For the past twenty years the Army Air Corps has used B G Mica Insulated Spark Plugs



THE B G CORPORATION

Contractors to the United States Army, Navy and Coast Guard and Aircraft Engine Builders

The Birdmen's Perch

LAST CALL!—*They're almost all gone!* This is our third and final announcement of the Gulf Aviation Atlas. The 5th edition—big, fat, and full of flying info, maps, charts, pictures, air history, etc.—is yours for the asking. You'll be glad you wrote for your free copy. Address—

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips,"
Mgr. Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

MORE-FOR-YOUR-MONEY DEPT.

Get this straight. We don't claim for one second that our quarts are any bigger than the next guy's.

But we *do* solemnly aver that there's a darn sight more lubricating value per quart in Gulfpride Oil.

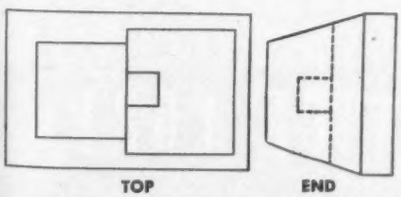
You see . . . Gulfpride is refined both by conventional methods and by the famous Gulf-patented Alchlor process. That's the technical triumph that burrows down still further into the 100% Pure Pennsylvania . . . *digs out more sludge and carbon-formers.*

T.W.T. PROJECT #3

Last month, after reading a stack of mail that had to be written on asbestos in re allegedly hard projection problems, we made a promise.

We guaranteed to find one that would fill padded cells by the gross. We found it all right. But so much space would be required to put it in print that The Whopper Club'd be crowded right off the page. In our capacity as Literary Editor, we couldn't let us, as Puzzle Potentate, do that.

So we rustled up another. One that may possibly take some of our heckling friends a moment or two more to work out. Nothing hard, however, fellas. (heh, heh!) Shouldn't take you any time at all to project that front view.



(Old T.W.T. is waiting for the answers. Send yours in and get our solution by return mail.)

THIS MONTH'S WHOPPER

Dear Al:

Now I have a bone to pick with Norman McEwen, a real raw bone. I'm a Floridian and I won't stand for any belittling of our Florida mosquitoes. Of course, Norm is right when he says they aren't as large as the California variety. Nothing in Florida is as large as in California. Not the seeds in the oranges, not the fog on the coast, not the frost, not the and-so-forth. But when it comes to calling our mosquitoes "Pygmies", that's a downright outrage! Libelous, I calls it!

Why, I remember the time a broken control cable forced me down in the Everglades. The mosquitoes knocked me down the minute I wiggled out of the cockpit. Then they stuck in their hoses and began to drink. Say, boy, you know they have 3 separate stomachs and wobble pumps from one into the other. There's no bottom to them. I could see there was going to be no end to it if I didn't do something.

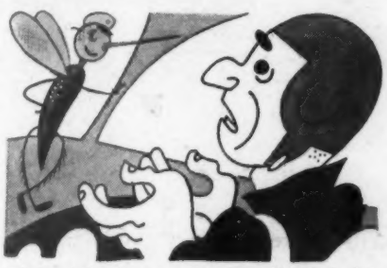
I gets up. I grabs a blade off the busted prop and carves a hole through this cloud of winged babies back to the cockpit. I pulls the closure over my head and slumps exhausted in the seat. However, there to my dismay sits a big, husky-looking old boy right on the instrument panel. He musta flown in after me. His hypodermic needle was as long as the lubber line on the

compass. He eyes me sourly for a minute. Then he opens his mouth and addresses me in perfectly good English. Says he, "Brother, I'm flight officer of this formation and I'll make a deal with you.

"It's like this," he says. "We're sick of eatin' Indians and you're the first white man we seen since Ponce De Leon. Now what we want is to git into Miami."

"But," I countered, "there's plenty of mosquitoes in Miami already."

"Yes," says he, "but *we* ain't there. And if *you* don't help *us* to git there, YOU ain't never



goin' to git there no more neither." And he glances meaningly out at the crew what was already drilling holes in the iseinglass. "I'm open to any proposition," says I. "That's better," says my Everglades Eagle. "That's better," says he and goes on. "You see it's like this" he grumbles, "me and the flight outside are pretty long-winded all right, but the 100-mile hop to Miami on the fuel we get in these swamps is just too much. So here's our proposition. If you'll unscrew the filler cap on your gas tank and let us fill up on G.A.G., we'll not only be able to make Miami nonstop ourselves but we'll hook our snouts together and build a stretcher for you to sit on and you can hitch hike right along with us."

"Can't be done," says I, "y'aint big enuf!"

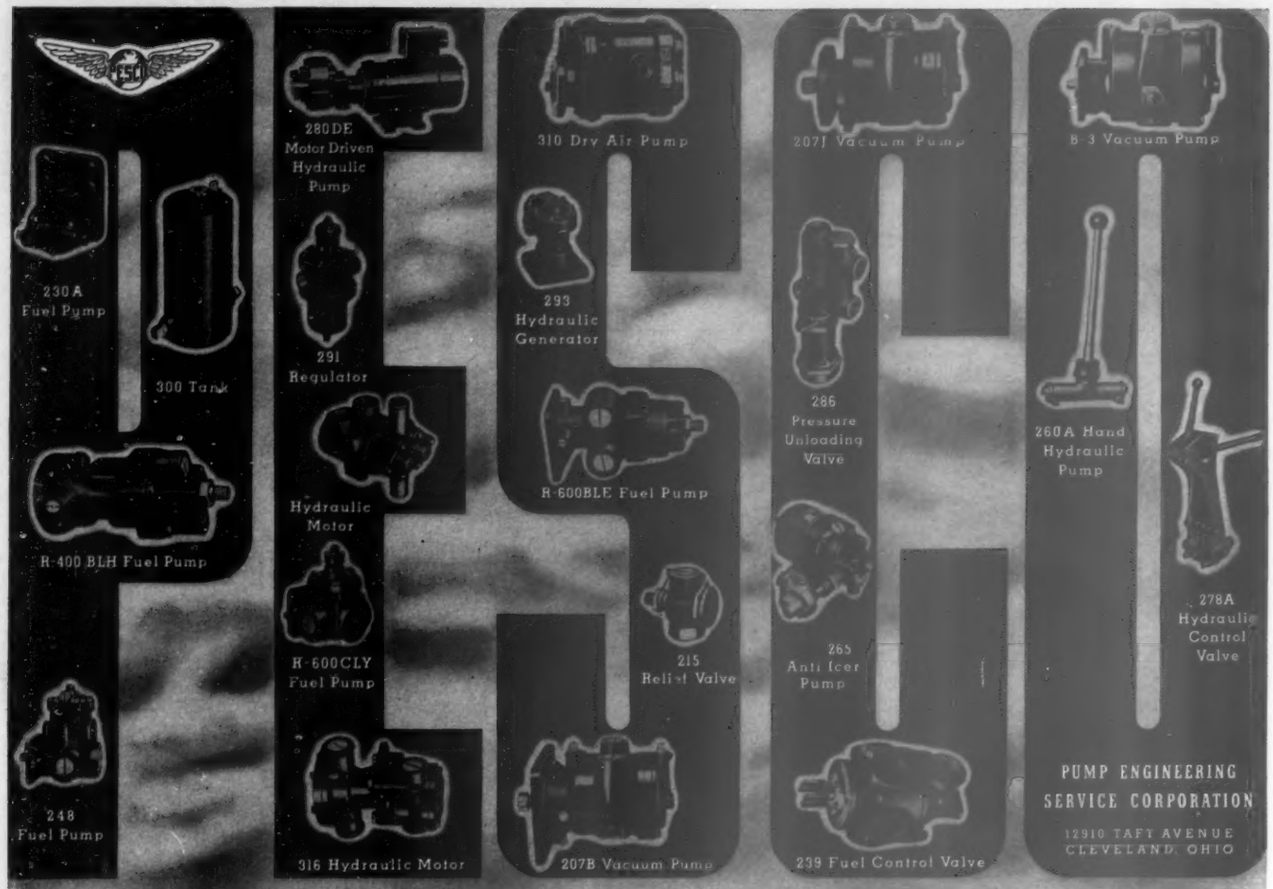
"Ain't big enuf, heck!" he snorts, "You don't need *size* to git *strength* when your belly tanks is full of G.A.G.! Say, what kind of an ignorant pilot *are* you anyhow?"

"You win," I says, and pulls off the cap to the gas tank. In 3 minutes those mosquitoes had sucked my tank so dry it didn't even smell! In 3 minutes more they had woven a stretcher out of their snouts for me to sit on, and 3 minutes after that we were all sittin' on the Miami Municipal Airport, 100 miles away! If G.A.G. can put that speed into mosquitoes, what the deuce can it put into aircraft engines?

William W. Kane

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF **GULF AVIATION PRODUCTS**



WHEREVER YOU FIND OUTSTANDING AIR ACHIEVEMENTS PESCO PRODUCTS ARE PLAYING THEIR PART

An airline wins a maintenance award... PESCO standard equipment is a factor. A racing plane sets new speed records... PESCO pumps operated faultlessly to make it possible. Higher and finer performance standards are set by military aircraft... PESCO products help raise them. Eight airlines are cited by the National Safety Council for outstanding safety records... all of them standardize on PESCO equipment for unfailing service.

CONTRACTORS TO THE U. S. GOVERNMENT FOR APPROVED AIRCRAFT ACCESSORIES

PUMP ENGINEERING SERVICE CORP.

12910 TAFT AVENUE, CLEVELAND, OHIO
DIVISION BORG-WARNER CORPORATION

AVIATION MANUFACTURING

Douglas Rushing DC-5's Deliveries to Start this Fall

Production of twelve Douglas DC-5 transports, the latest Douglas commercial model, is under way at the El Segundo Division of the Douglas Company. Deliveries to domestic and foreign airlines are scheduled for the latter part of 1939 and thereafter. Among those slated to receive DC-5s are KLM, which has ordered four, Pennsylvania Central Airlines, which has placed an initial order for six; and Scadta, of Barranquilla, Colombia, two. Of 16-passenger capacity, the DC-5 carries a crew of three. The cabin is divided into three luxurious compartments. The high wing mounting and use of a tricycle type landing gear help make the DC-5 ideal for small-field operation. Wing span is 78 ft., gross weight 20,000 lbs., and top speed 230 mph. Engineering and technical refinements of the DC-5 were developed under the supervision of Edward H. Heinemann, chief engineer of the El Segundo Division, and Edmund R. Doak, its general manager and a vice president of the Douglas Company.

A unique ceremony was held aboard the giant Douglas DC-4 on June 19th, when forty men, most of them prominent in the aircraft industry, honored Donald Douglas on the 25th anniversary of his entrance into commercial aviation. Feature of the ceremony was the cutting and serving aloft of a 75 pound cake. On board were Donald W. Douglas, his father William E. Douglas, and other Douglas company executives. The DC-4 was piloted on the anniversary flight by Major Carl Cover, senior vice president of the Douglas company.

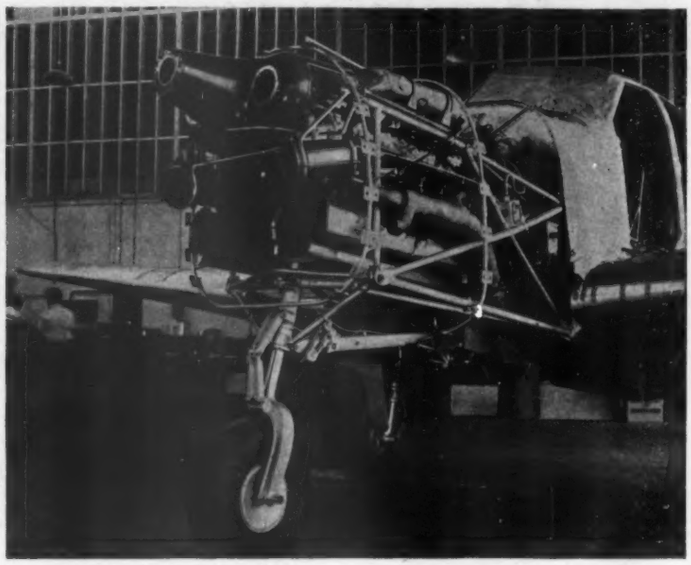
Mead Resigns from United Aircraft

United Aircraft Corporation last month announced with regret the resignation of George J. Mead as vice-president, director, and chief engineer of the corporation.

Mr. Mead attended the Massachusetts Institute of Technology. His activities in the aircraft industry began in 1917 when he was associated with the Wright-Martin Aircraft Corporation of New Brunswick, New Jersey, as experimental engineer. In 1919, he left this position to become engineer in charge of the power plant laboratory of the United States Army Air Corps at Dayton, and in 1920 was made chief engineer of the Wright Aeronautical Corporation at Paterson, New Jersey. He resigned in 1925 to become one of the co-founders of the Pratt & Whitney Aircraft Company, of which he was vice-president and chief engineer. He was elected vice-president of United Aircraft and Transport Corporation in 1929, and in 1935 was made vice-president, director, and chief engineer of United Aircraft Corporation. In 1937, Mr. Mead was awarded an honorary degree of Doctor of Science by Trinity College.

Northrop Offers Shares

Northrop Aircraft, Inc., newest vehicle for the engineering and design talents of John K. Northrop, was off to a flying start late in June with the offering of 400,000 shares of common stock following approval of the Northrop registration statement by the Securities and Exchange Commission in Washington. Northrop announced that a factory would be erected immediately on a 19-acre site adjoining Long Beach Municipal Airport. The factory should be in operation within 90 to 120 days, he stated, and will undertake sub-contracting work for other aircraft firms while perfecting its own designs. Approximately $2,000,000 is being raised by the initial financing, of which about $500,000 will be invested in factory and equipment, and the balance held in reserve as working capital. Factory personnel of between one and two thousand persons is expected to be required in the near future. Associated with Northrop are: Lamotte T. Cohu, chairman of the board and general manager; Gage Irving, vice president and production superintendent; E. A. Bellande, sales and test pilot; and Raymond S. Madison, treasurer and comptroller. Activity of the company at this time will be concentrated on the design and production of small and medium size military aircraft of pursuit, attack or light bomber type.



TWO IN ONE: The Unitwin power plant of Vega's new Starliner.

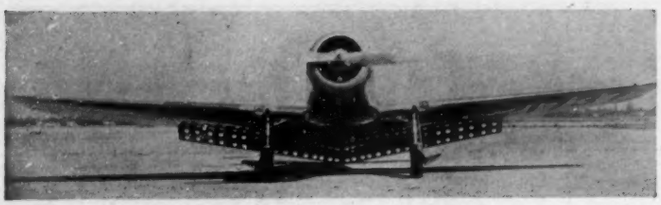
HAPPY RETURNS: William E. Douglas congratulates his son Donald on a 25th anniversary.

Vega Tests New Ship

It "exceeds expectations"

Successful completion of first flight tests of the new Vega Starliner has been announced by Mac Short, president of the Vega Airplane Company, a subsidiary of the Lockheed Aircraft Corp. Vernon Dorrell, Vega test pilot on initial flights, reported that flight performance of the new model exceeds design expectations. The Starliner is now to be subjected to a 250-hour schedule of flight tests preparatory to the gaining of an ATC from the CAA.

An unsual amount of interest has been evidenced in the progress of the Vega Starliner, due to the many unusual features incorporated in the design. Of pleasing, but unconventional appearance, the Starliner is an all-metal low wing monoplane with automobile-like cabin accommodations for pilot and up to five passengers. Landing gear is of tricycle, or "level-landing" type, and is retractable vertically, leaving part of each wheel exposed for emergency belly landings. Most unique feature of the plane is its use of the new Menasco Unitwin powerplant, incorporating two Menasco C6S 260 h.p. engines driving a single Hamilton-Standard constant-speed



THE NEW HARLOW: Designated the PC-5 Trainer, this tandem two-place mounts a Warner Super Scarab.

propeller through over-riding clutches. This arrangement simplifies powerplant installation, eliminates drag of wing nacelles, and provides center-line power application, even with one engine idle.

The Starliner has a gross weight of 6,000 lbs., top speed of 210 mph., cruising speed 184 mph., cruising range of 1,060 miles, and a ceiling of 21,500 ft. Landing speed is 61 mph.

One Vega Starliner has been purchased by Mid-Continent Airlines, of Kansas City, and will be put in service during this summer on the North and South Dakota part of the line. A preliminary production lot of five Vega Starliners are now coming through the factory.

Harlow Goes to Town

Tests trainer; starts production; names distributors

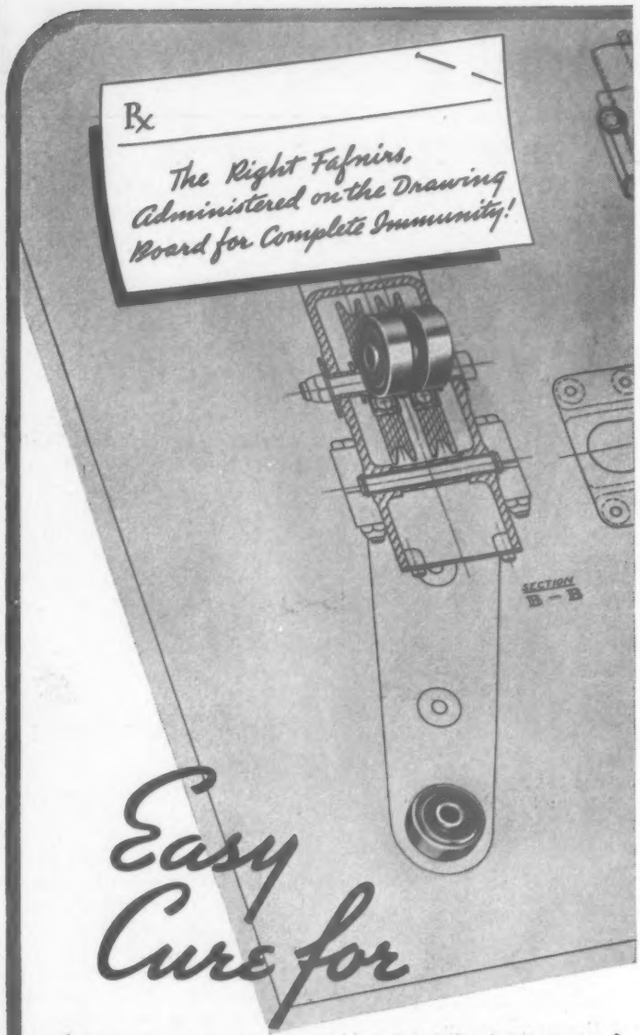
Already in commercial production of its four place cabin plane, the Harlow Aircraft Company conducted first test flights on its new two-place tandem trainer early in July. The new trainer is being offered to the Army as an advanced primary flight trainer, providing instruction in operation of flaps, retractable landing gear, controllable pitch propeller, and flight in a plane of type and performance similar to high speed military equipment.

Production is now under way on a $25,000 order from the Civil Aeronautics Authority for a fleet of four-place Harlow cabin monoplanes to be used for personnel transportation. This is an all-metal low wing cabin monoplane powered with the Warner Super Scarab engine of 145 h.p., and equipped with flaps, retractable landing gear, and controllable pitch propeller.

Harlow distributors recently appointed include Jack O'Meara for Minnesota, North and South Dakota, and Northern Wisconsin; Howard Ailor for New York; E. W. Wiggins for New England; Harry Hammill, of Austin, Texas, for the South-West; Frank Clark for Northern California and Nevada; and John P. Fulton for Southern California and Arizona. The Harlow PJC-1, two-place cabin plane has already been granted an ATC, and the PJC-2, a four-place model of similar type is now undergoing tests.

The new Harlow, designated the PC-5, is now undergoing preliminary flight tests which have, to date, demonstrated performance exceeding design specifications. The PC-5 Trainer closely resembles the Harlow personal transport four-place plane recently announced. In appearance it is quite similar to the Army's newest all-metal low wing pursuit planes. Seating arrangement of the trainer is two-place tandem in a smoothly contoured cabin. Incorporated in the design are features which make it applicable to training flight students from primary through advanced flight instruction. Although the plane is equipped with electrically operated flaps, retractable landing gear, and controllable pitch propeller, it is a thoroughly practical primary flight trainer without using any of these accessories. Following sufficient instruction in operation of the plane as a conventional trainer the student is introduced step by step to the operation of flaps, retractable landing gear, and the controllable propeller.

The Harlow PC-5 Trainer has a span of 35 ft. 9¾ in., length of 23 ft. 4 in., height of 7 ft. 8 in. It is equipped with a Warner Super Scarab engine rated at 145 hp.



Easy Cure for

"PULLEY PALPITATION"

It took ten long years of development to produce the Fafnir Pulley Bearings that outlaw wobble and friction in the Lockheed blue-print shown above. Fafnir design, materials, and precision manufacture provide the frictionless motion, combined with extreme rigidity, that assure a "sweet" control system — through countless flying hours of heat and cold and constant movement. And on the ground, these virtually non-wearing bearings eliminate the maintenance that goes with wobble, sloppy cables, frequent tightening of turnbuckles. *For your application*, you'll find the right bearings, with complete specifications and capacities, in Fafnir Catalogs, which will be sent to you promptly on request. The Fafnir Bearing Company, Aircraft Division, New Britain, Conn.

FAFNIR

THE BALANCED LINE . . .

50,000 RESULTS OF TEAMWORK

(Fafnir and Hamilton Standard)

"Grief" makes news. That's why the student pilot who nosed over at Oskaloosa rates page one of your newspaper, while the story of the airline flying its millionth mile goes back under the recipes for corn bread.

That's why, to illustrate teamwork, we tell you about the elimination process that led up to

50,000 Fafnir Bearings now carrying up to 85-ton thrust loads in Hamilton Standard Propellers the world over. Most of the time, teamwork avoids special bearings, instead of suggesting them. We like to find aircraft manufacturers who think they need "super-specials" and introduce them to standard Fafnirs already made for the job. But those aren't news, so here's the Hamilton Standard story:

The bearing wanted was the one at the root of each blade, on which the blade turns when it changes pitch. On an 1500 h.p. engine, this bearing carries an 85-ton thrust load, yet must permit the blade to turn freely.

First try was to install two halves of a split bearing on the finished propeller blade. Verdict: satisfactory, but expensive where precision must be maintained. Second try, a one-piece washer-type thrust bearing slipped over the root of the blade and secured by a ferrule. Verdict: OK, but the screwed-on ferrule might not "take it." Final result, a finished bearing that's slipped over the root of the unfinished blade. Made of special steel, this bearing withstands a temperature of 950°F going through the blade heat treatment. On the finished blade, it's right in place, ready to go. 50,000 such bearings are now giving satisfactory service.

Proof that in Fafnir's separate Aircraft Sales and Engineering department, we make it our job to solve bearing problems through cooperation. Teamwork that produces intricate special bearings when necessary, but usually finds the right bearing for every spot on every ship promptly . . . from the most complete line in America. The Fafnir Bearing Co., Aircraft Division, New Britain, Conn.

Ball Bearings . . . MOST COMPLETE IN AMERICA

For Aircraft Engines and Controls

Beech Payroll Trebles

A triple increase in employment marks the recent progress of Beech Aircraft Corporation, whose workers have been increased within the year to more that 700, operating on a 24-hour schedule. Mr. Beech reported that unfilled orders will have exceeded the total output for 1938 by July 1st. All this requires more space, and a new plant is under construction which will double office and engineering space, and add considerably to the manufacturing area. The company is preparing to go into production soon on the twin-motor monoplanes and the single-motor biplanes which the Army has ordered.

Corpe Joins Lockheed

Lockheed Aircraft Corp. has named Thomas H. Corpe, formerly of the General Motors Corp., as director of all advertising and promotion. Corpe served with the Canadian and Royal Flying Corps during the world war. He will be assisted by Caden Jenkins, formerly with Vega, Lockheed subsidiary.

Kinner, Herring, Sullivan

Kinner Motors, Inc., has paid in $200,000 to Kinner Airplane and Motor Corp., Ltd., through Trustee Earl Herring, and is planning to operate in future under the new firm name. Earl Herring, formerly manager of Airplane Parts & Supplies, has been named general manager of Pacific Airmotive Division of Bendix Aviation, Ltd., and will continue for the present as general manager of Kinner Motors, Inc., as well as of Airplane Parts & Supplies. Ray Sullivan, formerly Pacific Airmotive general manager, has resigned to accept a position as sales manager of Continental Aeronautic Corporation, Burbank.

THE GIRL—Is Eleanor Holm. The cup is the trophy posted (with $2,000) by Allegheny Ludlum Steel for a new record in the Thompson.

WICHITA TURNED OUT—last month to honor Walter Beech, favorite son and head of bustling Beech Aircraft, on the 25th anniversary of his entrance into aviation. This is Walter just after he won the National Air Tour of 1927.

Solar Pushes Airmax

Solar Aircraft Company, San Diego, is in production on an initial lot of seventy-eight units of its new Airmax heating system, according to announcement by Edmund T. Price, president. The initial order is for installation on U. S. Army planes now under construction. Additional Airmax units are being manufactured for anticipated commercial orders and for stock. The American Export Airlines Consolidated flying boat, now engaged in survey flights over the Atlantic route, carries the first commercial installation of the Solar Airmax steam heating system. The new Solar factory, doubling capacity of the former plant, is now in operation, making early deliveries possible despite the highest backlog of unfilled orders in Solar history.

Ryan Opens New Plant

Early in July the equipment and personnel of Ryan Aeronautical Company moved across Lindbergh Field to the new Ryan Factory; a 200 by 275 ft. building on which work was commenced May 1st. The former Ryan factory building is now occupied by ground school classes of the Army flight training program. In its new quarters Ryan has greatly improved production facilities, including installation of eight Ryan drop-hammers, heat treating equipment, electric spot welders, anodizing, plating and painting shops, a five-ton travelling crane and complete new Pangborn sandblasting equipment. New Ryan factory buildings erected or in the course of construction include, in addition to the main factory building, a new office building, a dope and paint shop, and a modeling and pattern shop building for construction of drop hammer die patterns.

Taylor to Represent N.A.

Appointment of Leland R. Taylor as Eastern representative of North American Aviation, Inc., has been announced by J. H. Kindelberger, president. Taylor will establish headquarters in Washington, D. C. and will act in a liaison capacity between the Army, Navy, and the Inglewood factory of North American. His responsibilities include contact with activities at Wright Field, Dayton, Ohio. Prior to accepting his post with North American Aviation, Taylor was for more than nine years connected with the Douglas Aircraft Company.

Quinn Joins Kellett

Expansion of Kellett Autogiro sales activities on the Coast, because of increases of business in the subcontracts division, has resulted in the association of Cecil B. Quinn of Los Angeles as West Coast sales representative. After service with the U. S. Naval Aviation during the World War, Quinn entered commercial aviation in 1927. From then to the present he has been with Aero Corporation of California, Douglas Aircraft, Inc., and Aircraft Industries, all in the Southern California area.

Air Associates Elect

At a recent meeting, Air Associates, Inc., elected as directors: Howard Beazley, Gilbert Colgate, H. I. Crow, F. L. Hill, Edward Latham, S. A. McClellan, H. B. Page, Roland Palmedo, G. B. Post, J. B. Taylor, Jr. The following officers were re-elected: Gilbert Colgate, chairman of the board; F. Leroy Hill, president; H. I. Crow, executive vice president; R. E. Acre, vice president; G. S. Kleverstrom, secretary-treasurer. Haven B. Page, an officer since 1927, was appointed Washington counsel.

FINANCE

» Air Associates, Inc. declared the regular quarterly dividend of 50 cents on the common stock, payable June 26th. By this action the company maintained an unbroken common stock dividend record since the summer of 1937.

» Aviation Corporation and subsidiaries: for four months to March 31, 1939, net loss of $782,757, after $97,480 loss on sale of securities. Current assets, including $495,652 cash and securities, at cost, amounted to $2,412,739, and current liabilities to $556,602. Compares with cash and securities of $1,697,791, current assets of $3,554,086 and current liabilities of $549,530 as of Nov. 30, 1938. Inventories, after obsolescence reserve, were $1,595,365 against $1,456,259. Net loss for quarter ended Feb. 28, 1939, $426,280.

» Douglas Aircraft Co. Inc., for six months ending May 31, 1939, consolidated net profit of $1,396,791, equal to $2.45 each on 570,680 shares, against $1,093,149 or $1.91 a share for the same 1938 period. Consolidated net profit for three months of current fiscal year to Feb. 28, 1939, was $771,552, equal to $1.35 per share.

» Howard Aircraft Corp. AVIATION'S report on this company in our July issue was not in line with the facts as reported in the company's latest report. The correct report for the six months ending May 31, 1939; Net loss, $19,751. Net loss, including development expenses from date of inception in January, 1937, to April 30, 1939, $87,646. Current assets as of May 31, 1939, $232,382, including $170,143 cash; current liabilities, $4,458. Compares with current assets of $54,083, with cash of $10,746; and current liabilities of $101,867, on Nov. 30, 1938.

» Piper Aircraft Corporation, regular quarterly dividend of 15 cents a share covering the period of March 1 to June 1, 1939, on the 60 cents no par value preferred stock.

» Solar Aircraft Co., for year ending April 30, 1939, net profit of $26,764, equal to 12 cents a capital share on 228,900 shares. Compares with net income of $22,299 in previous year, equal to 17 cents on 129,640 shares.

CALCUTTA
NEW YORK
DENVER
SAN FRANCISCO
CAIRO
AMSTERDAM
11
12
10
9
8
7
6
5
14 TIMES AROUND THE WORLD TODAY AT NOON!
The International fleet of Douglas transports in scheduled airline service flies approximately 350,000 miles every 24 hours. Thus "around the clock" with Douglas means 14 times around the world. On this basis the world now depends on Douglas for mail, cargo and passenger transportation to the extent of 127,750,000 miles yearly! This service record, unparalled in aviation annals, is possible only because of the dependability and operating efficiency Douglas builds into airplanes. Douglas Aircraft Co., Inc., Santa Monica, Calif.
Douglas . . .
First Around the World
Now
the World Over
DOUGLAS
NORTH AMERICA: American Airlines Inc. . . . Braniff Airways . . . Canadian Colonial Airways, Inc. . . . Eastern Air Lines . . . Northwest Airlines, Inc. . . . Pan American Airways . . . T. W. A. . . . United Air Lines . . . Western Air Express . . . Wilmington-Catalina Airline . . . Cia Mexicana de Aviacion, S. A., Mexico . . . SOUTH AMERICA: Pan American Airways . . . Pan American Grace Airways . . . AUSTRALIA: Airlines of Australia . . . Australian National Airways . . . EUROPE: A. B. Aerotransport,

THE Kollsman Company has been serving the Army Air Corps since 1928, the year the company was founded. To-day, Kollsman Instruments, developed for or in cooperation with the Army Air Corps, play an important part on every army instrument board. Examples are Kollsman Sensitive Altimeters, the present Air Corps standard; Kollsman Electrically Heated Pitot-Static Tubes; Kollsman Vertical Speed Indicators; Kollsman Manifold Pressure Gages of the capsule type; special types of accelerometers, and several types of magnetic compasses. Kollsman Rim Lighting, now used by many manufacturers of instruments for the Air Corps, is another outstanding Kollsman development.

The Kollsman Company salutes the Army Air Corps in recognition of its constant encouragement of greater precision, greater reliability, greater serviceability in aircraft instruments.

KOLLSMAN INSTRUMENT CO., INC.

8008 FORTY-FIFTH AVENUE ELMHURST, NEW YORK

WESTERN BRANCH: GRAND CENTRAL AIR TERMINAL, GLENDALE, CALIFORNIA

SEE THE ARMY AIR CORPS EXHIBIT AT THE AVIATION BUILDING, NEW YORK WORLD'S FAIR

ENGINEERING

Beall New Chief at Boeing Headed Commercial

Wellwood E. Beall has been promoted to the post of Chief Engineer of the Boeing Aircraft Company. Formerly Beall was engineer in charge of all commercial projects.

Beall studied mechanical engineering at the University of Colorado, then attended the Guggenheim School of Aeronautics at New York University, where he received the degrees of Bachelor of Science in Mechanical Engineering and Master of Science in Aeronautical engineering.

After a period of airplane and motor-coach design work in California, Beall in 1930 became an instructor at the Boeing School of Aeronautics in Oakland, California, which was then affiliated with the Boeing Aircraft Company. He was subsequently placed in charge of all engineering at the school.

In 1934 he became a sales engineer for Boeing, then was made far eastern representative, in which capacity he spent a year in the Orient. Upon his return he was transferred from sales to engineering work, and in the summer of 1936 became chief commercial projects engineer.

"Engineering Stylist"

Newton S. Leichter, for a number of years director of engineering styling and passenger comfort problems for the Douglas Aircraft Company, in connection with development of the DC-4, DC-5 and other designs, has created a new aeronautical title by establishing himself as an independent consulting "Aeronautical Engineering Stylist". Leichter's first job under the new title is to consult on styling problems of the new Lockheed "Excalibur" four-engined transport. He is also active in styling for Harlow Aircraft. An "Aeronautical Engineering Stylist", according to Leichter, specializes in problems of lighting, ventilating, seat engineering, color engineering, and cabin arrangement—in fact, he tackles any problem concerned with passenger comfort.

New Sleeve-Valve Engine

The single-sleeve-valve engine is not completely dead in America. Recently Ashley Cooper Hewitt, former member of the engineering staffs of the Mack Truck Company, the Wright Aeronautical Corporation, and the Menasco Manufacturing Company, wound up three years of development work by publicly demonstrating a single-cylinder, single-sleeve-valve, air-cooled engine which he pronounced a perfected test unit ready for application to aircraft powerplants, or to aircraft auxiliary power units. The Hewitt test engine is a four-stroke cycle engine similar in general to the well known English Bristol type. The sleeve valve operates directly in a cast aluminum cylinder. The test engine has been driven at speeds up to 8,500 rpm and has been operated for more than 100 hrs. at speeds approximating 6,000 rpm. Hewitt has yet not perfected plans for commercial production, but believes he has solved the engineering problems incident to production.

WELLWOOD E. BEALL
Adds fortresses to his realm.

Allen On Stratoliners

First-hand comments on first supercharging tests of the Boeing No. 2 Stratoliner June 20 by Edmund T. Allen, Chief Test Pilot: "At an altitude of 16,500 feet, as far as atmospheric pressure in the airplane was concerned, we were never above 9,000 feet." In making a descent from 16,500 feet to 6,000 feet a rate of 600 feet per minute was held, but there was no sensation of rapid descent because the pressure regulating device kept the cabin atmosphere at virtually a constant pressure, as though in level flight. As for temperature, Allen said, "the instruments showed it was nine degrees below zero, Centigrade, (sixteen above zero, Fahrenheit), outside, and inside the cabin we were perfectly comfortable in our shirt sleeves."

The altitude-conditioning system consists merely of mechanical blowers that increase the pressure of the air as it enters the plane's ventilating system, and automatic control valves that regulate the inside atmospheric pressure so as to be kept constant. Two such units are installed in the Stratoliner, either one of which is capable of handling the entire cabin pressure requirements alone.

Repeated tests of the supercharged cabin have been made since this initial test, the last one reported being July 6 when the ship was taken to 22,000 feet. Even at this altitude, according to Eddie Allen, the pressure regulating equipment "functioned perfectly," and conditions inside the cabin were as if flying at ordinary altitudes.

"Fixed Slots OK", Hibbard

According to Hall L. Hibbard, Vice President and Chief Engineer of the Lockheed Company, the built-in wing slots mounted on all Lockheed-14 Models since last Spring (see AVIATION for May, 1939) are paying heavy dividends in pilot satisfaction. In what amounts to an invitation to all other airplane manufacturers to "step up and have some of the same," Hibbard points out that patents on the fixed slot idea were taken out as long ago as 1919 and have since been allowed to lapse. To judge from the success of the Lockheed installations in all kinds of service, commercial, private, and military throughout the world, these fixed Lockheed slots are just what the doctor ordered to stop headaches produced by higher and higher wing loadings and sharper and sharper tapers.

In case you don't remember the details, the Lockheed slots extend spanwise across approximately 60 per cent of the aileron. They are not continuous, being installed in five increments on each wing, thus sidestepping changes in the wing structure. Openings start immediately behind the point in the chord where standard deicer boot installations leave off. Under normal angle of attack, high speed conditions, or cruising, there is practically no flow of air through the slots. As a result there is no appreciable increase in the drag of the wing at cruising speeds. Even at top speed, the slots cost the Lockheed only two mph.

CONCOCTED A MYSTERY: Last month our War Department disclosed a new 18-cylinder Pratt & Whitney engine which had come through its 150 hr. tests with colors flying. Beyond that the W. D. couldn't say. P. & W. was equally discrete, added only that the new engine was the result of brilliant work by A. V. D. Willgoos (top) and Leonard S. Hobbs.

If YOU are STANDING on the SIDELINES of AVIATION

WATCHING it grow
READING about its stirring triumphs
HEARING about its spectacular progress
But Not DOING anything about it, why not . . .

. . . GET INTO THIS PICTURE

Here you see men who are doing something about Aviation's swift growth. Like them, you too can learn how to design, build, or maintain today's great planes—the Aero I.T.I. way.

The Aero I.T.I. way to prepare for an Aviation career means that you use the same tools, operate the same equipment, and perform the same duties you'll find right in aircraft repair stations . . . at air line maintenance bases . . . in aircraft plants.

Even if you start your course at home, this actual shop practice is a part of your training. For free booklet and information on Aviation and Aero I.T.I. training—send the coupon NOW.

Aero Industries Technical Institute
5261 West San Fernando Road, Los Angeles, Calif.
Aircraft Mechanics . . . Aeronautical Engineering
Offering U. S. Civil Aeronautics Authority Approved
12-Months Aircraft Mechanics Training

EXECUTIVE BOARD

C. A. VAN DUSEN	JOHN K. NORTHROP	ROBERT E. GROSS
Vice-Pres., Consolidated Aircraft Corporation	formerly Pres., The Northrop Corp., and Vice-Pres., Douglas Aircraft Co., Inc.	Pres., Lockheed Aircraft Corporation

AERO INDUSTRIES TECHNICAL INSTITUTE
5261 West San Fernando Road, Los Angeles, California
Please send information on Aero I.T.I. training. I am interested in the branch of Aviation checked below:
☐ Aircraft Mechanics ☐ Aeronautical Engineering
☐ Undecided. Please send more information.
Years of High School: ☐ None; ☐ 1; ☐ 2; ☐ 3; ☐ 4.
NAME _____ AGE _____
ADDRESS _____
CITY _____ STATE _____ a-16-a

LA GRANDE SOUFFLERIE HISPANO SUIZA *Wide World*
Otherwise the Hisso companies new tunnel at Colombes

Shanley Pinch Hits for C.A.A.

The Airworthiness Section of the C. A. A. has engaged F. R. Shanley for a limited period to make a study of the Airworthiness Requirements pertaining to aircraft and to write recommendations for their revision. Shanley has been granted leave of absence by Lockheed Aircraft and Curtiss-Wright Technical Institute, where he is employed as Structures Staff Engineer and Chief Engineer, respectively.

New Hisso Tunnel

The Hispano Suiza Company has recently built a large wind tunnel for testing motor nacelles and nacelle mountings at Bois-Colombes, France. The tunnel (see photograph) is of the open-throat open-return type, with the experimental section enclosed in a square housing to make outside disturbances a minimum.

The maximum speed obtained in the tunnel is 208 m.p.h. through a working section 31 ft. long and 15 ft. in diameter. The over-all length of the tunnel is approximately 180 ft. using a 26 ft. 12-bladed propeller. The propeller and a synchronous motor (absorbing 3,000 killowatts at 208 m.p.h.) are mounted in the rear of the tunnel with the motor encased in a nacelle. The size of the working section permits the testing of full size nacelles and mountings.

The balance used in the tunnel supports the model at its point of equilibrium, and through a system of levers leading to a table below, measures the usual components of lift, drag, pitch and roll. The maximum vertical force measurable is 13,000 pounds, with an error in the order of 9 pounds, and that for the horizontal force is 6,600 pounds with an error in the magnitude of 2 pounds.

Minser on Lightning

E. J. Minser, Chief Meteorologist for TWA, spoke at Elmira on "Meteorological Conditions Associated with Aircraft Lightning Discharges and Atmospherics." Discussing the problem, Minser stated, "From twenty-five accurate case histories, it has been possible to establish a list of the conditions prior to and during a lightning discharge. These conditions have existed not in a majority of cases but in practically all cases.

The conditions are:

1. Altitude—Of no importance. Range 2,000 feet to 18,000 feet.
2. Cloudiness—Aircraft on instruments in cumulo-form clouds.
3. Temperature—25 to 33 degrees Fahrenheit, lowest, minus 5 degrees; highest, 40.
4. Electrical Phenomena—Increase in static to a steady roar during daylight. Corona discharge plus severe static at night.
5. Precipitation — usually rain, frequently sleet, rarely snow.
6. Turbulence — moderate to severe just prior to discharge."

According to the cases reported the damage caused by lightning is very slight. The cause of the strike is believed to lie in the fact that all-metal ships accumulate an electrical charge when flying through a cumulus cloud. The amount of the charge seems to be proportional to the speed and pilots have eliminated lightning effects by reducing their speed and losing altitude.

TRANSPORT AVIATION

Eastern Opens Shuttle

Giro saves truck delay on Philadelphia mail

Eddie Rickenbacker's new six-mile autogiro air line inaugurated July 6, in a flood of oratory and stamp collector's mail, is one of those things that dreams are made of.

First of all, it gives substance to all those fanciful drawings of windmill aircraft mid the skyscrapers which artists have been making of the City of the Future for, lo, these many decades. Mail trucks plowing their way through Philadelphia traffic. take from 25 to 45 minutes to carry their sacks from Philadelphia's 30th St. Post Office to the Camden Airport. The giro does it neatly in five. If the experimental contract held by Eastern Air Lines for five round trips per day works out satisfactorily, other cities in the U. S. will get similar giros as additions to their workaday skylines.

From a sheer flying point of view the operation looks pretty practical. The particular post-office used was designed about eight years ago, and local interest in the giro led it to be fitted specifically for giro landings. It is nearly square; two ends are clear of parapet walls; steam pipes have even been placed close to the surface so that snow and ice can be melted therefrom. Other cities (Chicago and New York are the two most important frequently mentioned possibilities) would require expenditures of considerable funds to fit post office roofs for the purpose. But the cost of such an adaptation is infinitely less than other possible devices such as pneumatic tubes which might be justified for the same purpose as air mail becomes more and more important.

On this particular roof, giro experts pronounce that landings will present little or no problem. There is a perfectly clear area available 350 × 275 ft. which to a landing giro looks like the Cleveland Airport, even in a dead calm. Take-offs are somewhat more critical. In a dead calm or very slight wind 350 ft. is more than ample. But a brisk wind in the direction of the roof's long axis produces a big whirl up over the windward edge of the building which gives the pilot an actual tail wind over the last quarter of his run. Airflow deflectors, which would function at the building corners very much as fixed slots, may turn out to be necessary. An article by Jim Ray incidentally described such a gadget in AVIATION for August 1935. Brisk cross-winds are going to pose real problems. New big-city post offices might well hereafter be designed with completely flat tops and post office architects might well work out the above-mentioned slots in stainless steel as a sort of super modern functional element of their design.

Almost as intriguing from an air transport point of view as the new use of rotary-wing aircraft, is the completeness of this vest pocket operation. Right up on the roof of the post office, Eastern Air Lines has installed a complete two-way radio station which gathers weather data, checks in with traffic-control, etc. When pilot John Miller poises his giro in one corner of the roof for his take-off, he checks in through his two-way radio for clearance just as he would at Camden. After take-off he checks in again and gets his go-ahead, even though he can already see the airport to which he is flying. He also checks in at Camden, of course, for clearance to land.

United Orders DC-4's

Will place six in coast-to-coast service

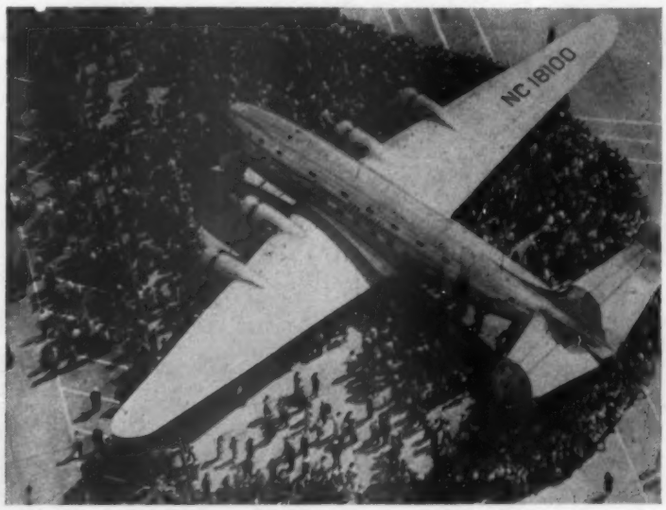
W. A. Patterson, President of United Air Lines, formally notified executives of four other American transport operators on July 14 that United intends to purchase a fleet of six 42-passenger Douglas DC-4 Super-Mainliners at a probable cost of $500,000 apiece. His disclosure was made to presidents of American Airlines, Eastern Airlines, Pan American, and Transcontinental and Western Air, all of whom are parties with United to a contract with Douglas Aircraft Company of Santa Monica, California for the construction of an experimental plane of this type, with which tests were recently completed. The six four-motored transports will be used by United on overnight coast-to-coast sleeper service, replacing its present 14-passenger DC-3 type sleepers, Mr. Patterson said.

"Decision to purchase six DC-4s was based on our estimate of the number of airplanes required to maintain adequate overnight coast-to-coast sleeper service," Mr. Patterson stated.

"Our analysis, checked by Independent market research groups, of expected traffic in 1941 shows that there will be sufficient traffic to warrant fleet operation of DC-4 airplanes. United's coast-to-coast business this year is 32 per cent ahead of last year. Use of the 42-passenger transports on short flights will probably not be feasible as such operation would impair frequency of service, which has built up traffic on short haul trips. The importance of the commuter type of service now prevailing between such cities as New York and Chicago and between Los Angeles and San Francisco, proves the public wants frequency of service primarily."

Wide World

EPOCH MAKING: Capt. John Miller of Eastern Air Lines inaugurates the world's first roof-top to airport shuttle July 6. Use of a Kellett KD-1B giro (equipped with a 225 Jacobs engine) opens a new era in air transport, a new field for rotary-wing craft.



EQUALLY EPOCH MAKING: United Air Lines' order last month for six four-engined Douglas DC-4's promises a new standard of luxury in domestic air travel. Above, is an air shot of part of a crowd of 300,000 which turned out to see the ship in Chicago.

THE AIRPLANE OF TOMORROW
...Today!
The amazing new Bellanca 14-9 is ready for the skyways. Fly this outstanding 3-place cabin job — retract the landing gear — loaf along at two miles a minute — enjoy the comfort of the extra-sized 3-place cabin — experience the safety and PLUS value of Bellanca ownership. It's a BELLANCA!
Watch for the 14-9 at your local airport. Flyaway price $3795 with retracting gear, hydraulic brakes, 90 H.P. radial engine * * *
BELLANCA AIRCRAFT CORP.
New Castle, Delaware

Pan Am Into L.A.?

Following christening of the sixth of Pan American Airway's new Boeing Clippers as the American Clipper, in ceremonies at Los Angeles harbor, it was announced by Mark T. McKee, Pan-American director, that Los Angeles will be included as a regular port of call on the U. S.-New Zealand service for which a franchise to operate on a fortnightly basis is being requested of the C.A.A. The present plan is to operate the American Clipper between Hawaii and New Zealand. No indication has been given as to how Los Angeles will be included in future Pacific flight itineraries.

T.W.A. Names Treasurer

E. Lee Talman, 34, of Chicago, has been appointed Treasurer of Transcontinental and Western Air, Inc. with headquarters in Kansas City, Mo. He succeeds Frank G. Wilson, formerly Vice President, Treasurer and Secretary, who resigned as Treasurer but remains as Vice President and Secretary.

In assuming his new post, Talman brings with him six years of aviation experience with the Bendix Aviation Corporation, having served as Assistant Treasurer of that company from 1929 until 1937. After graduation from Northwestern University in 1926 he was associated with the J. L. Jacobs and Company, Chicago, until 1929.

In joining T. W. A., Talman leaves the presidency of Industrial Supplies, Inc., affiliated company of Calloway Mills of La Grange, Ga., one of the largest cotton mills in the United States which he joined in 1937.

TRAFFIC

» American Airlines carried 54,042 passengers during June, representing an increase of 91 percent over June 1938. A new all-time record of 213,594 passengers was made during the first 6 months of 1939, a gain of 50 per cent over the corresponding period in 1938.

American's June passenger-mileage total also set a new world mark—19,999,352 passenger-miles compared with a total of 10,853,975 for June, 1938, an improvement of 85 per cent.

» Braniff Airways. Traffic over Braniff Airways during June reached a new high per month in flying 1,626,592 passenger miles. This represents an increase of 63.05 per cent over June 1938.

» Canadian Colonial Airways carried a total of 1,451 passengers during the month of June, a big gain over the 293 passengers for June 1938. 4,353 passengers were carried for the first six months of 1939 against 4,357 for all of 1938.

» Chicago and Southern Air Lines flew a total of 829,465 passenger-miles in June, representing a 38.2 per cent increase over June 1938.

» Gross revenue from the nation-wide air express service of the Railway Express Agency for May increased 39 per cent over May, 1938, the agency reported today. This monthly revenue record has been exceeded only three times since the service was inaugurated in 1927. May is not ordinarily a heavy month in air express.

» Trans-Canada Air Lines reports 223,510 passenger-miles logged for the month of May, an increase of 17 per cent over the preceding month. A total of 1,026,440 passenger miles has been flown for the first five months of this year.

» TWA reports a total of 9,920,109 passenger-miles flown during the month of June. This represents an increase of 21.8 per cent over 1938 figures.

» United Air Lines reported an unofficial total of 15,000,000 passenger miles for June, which is a 38 per cent increase over June 1938. This is a new record high for one month, the previous high being 13,193,890 passenger-miles for August 1937.

AIR TRANSPORT INDICATOR

July 1, 1939

157.8

Which is the ratio of the passenger-miles reported by the Air Transport Association for all domestic lines for June, 1939, to the figure for June, 1938.

Trends for the year continued excellent. For the first six months, traffic stood at 278,353,321 passenger-miles — up 33.7 per cent.

THE CONTROL TOWER

by DAN SAYRE

It's safety makes the mare go

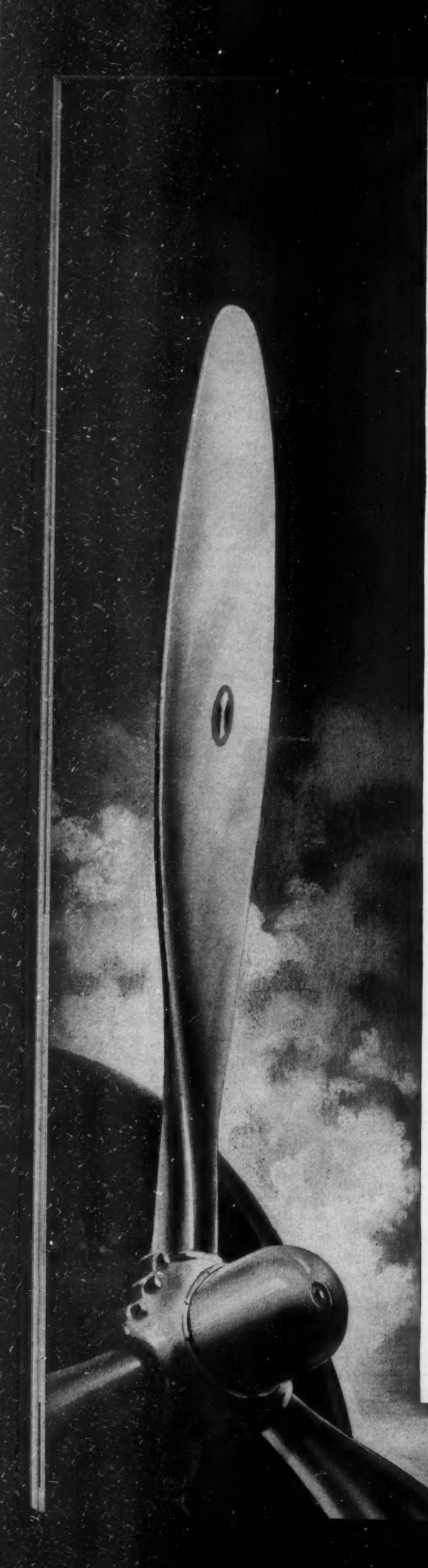
New York's Grand Central Terminal for the air line companies is finally going through. Details have been somewhat changed since the last of two preliminary announcements. But the building is to be erected, as planned from the outset, on the site of the old Belmont Hotel on the corner of 42nd St. and Park Ave.

Arrangements will be very fancy pants. As you out-of-towners may not know, 41st St. is at somewhat higher level than 42nd St. Also 42nd St. frontage is held locally at a very high premium. As a result, the 42nd St. frontage will be occupied by shops which will include a drug store and a coffee-shop restaurant. Passengers will enter the building via an escalator opening onto 42nd St. On what corresponds to the second floor will be a large waiting room. In the center will be an information desk manned by a very neutral staff of question answerers. Around the side of the room will be small booking desks manned by personnel from each of the air lines using the building—American, United, TWA, Eastern, Pan American. Most of the waiting room will be two stories high but there will be a mezzanine offering room for supplementary space to each company's booking desk. Above this mezzanine will be several stories of office space to be occupied by the reservations and district traffic personnel of the air line tenants.

Such a terminal will be a big boon to the industry. With prospects of North Beach being ready for use sometime this year (if the W. P. A. doesn't stay out on strike too long), it will mean that all air travelers will be able to go, without confusion, to an impressive and convenient office, be booked with the greatest dispatch, loaded onto a limousine and be delivered to North Beach within about twenty-five minutes.

Terms of the deal, although not fully disclosed, are understood to be very favorable to air lines. One of the big insurance companies owns the site and will underwrite the building more or less as a "taxpayer project." The airlines have formed a leasing company which will sign up for a ten-year period. One of the most attractive features is that all the foundation work of the old hotel has been left in place and can be fully utilized for the new building. Hence the announced building time for the whole thing of only 120 days really is credible. Meet you at the dedication in December!

Traffic figures these days certainly make fine reading. Most newspaper commentators glibly ascribe the boom to the two World's Fairs. And no one would deny that the World's Fairs have helped. Any number of people in the Midlands, figuring how best to use a two weeks' vacation, have undoubtedly used air travel to increase their visiting time. But to us and to a number of our air line traffic pals the Number One Boom-builder is the remarkable safety record the air lines have built up over the past 14 months. We haven't figured it lately but it must be breezing along at about three times better than any previous index. Another feature is the fact that every air line in the country is offering more schedules and generally greater convenience to the prospective traveler.



Airlines report on
HYDROMATIC

During the past year Hamilton Standard ard equipment on the major airlines of Hamilton Standard asked this question of

ACCUMULATED SERVICE. Hydromatic Propellers have already had hundreds of thousands of flight service hours, and have flown more than 60 million propeller miles on domestic airlines.

"We now have 94 propellers in use. The oldest propeller has approximately 2500 hours at this time and 45 propellers, or nearly one-half, exceed 2000 hours . . . The total time of all Hydromatic propellers in service on our air line at the present time is approximately 150,000 hours." — *American Airlines*

"We now have a total of 83 propellers in active service, including spares, a large number of which have over 2,000 hours total time. The highest time propellers are a little above 2,800 hours. This represents a total accumulated service time of over 110,000 hours . . ." — *United Air Lines*

"Hydromatic propellers in our operations have now aggregated a total of more than 40,700 service hours and some of the individual propellers have accumulated, as previously indicated, over 1,500 service hours." — *Transcontinental & Western Air*

"Seventeen thousand propeller service hours with thirty propellers . . ." — *Trans-Canada Air Lines*

WINTER PERFORMANCE. Hydromatic Propellers came through the severe tests incident to extreme cold weather operation with flying colors.

"No irregular operation or functioning of these units has been reported which could be attributed to low temperatures." . . . "am unable to give exact . . . air temperatures as our thermometers calibrated to minus 40 consistently operated against peg . . . estimate that air temperatures exceeded minus 50 degrees . . ." — *Trans-Canada Air Lines*

"Even in the coldest temperatures we have had no congealed oil engine difficulties reported in the propeller dome, on the ground, or in flight." — *American Airlines*

"We have not had any trouble . . . even with temperatures 18 to 20 degrees below zero." — *United Air Lines*

"In twenty-one thousand four hundred hours of operation of Hydromatic propellers in temperatures ranging from 55 below to 105 above we have had no delay or inconvenience." — *Northwest Airlines*

MAINTENANCE. Full pressure lubrication and improved design of the Hydromatic Propeller has greatly decreased the maintenance requirements.

"Our maintenance costs for routine daily service have been reduced almost 90% in comparison with the old controllable propellers. This is due to reduction in the greasing and servicing required and to the very marked improvement in synchronization which has reduced line maintenance problems as well. Our average material cost on the constant speed propellers was $23.47 per overhaul, while on the Hydromatic propellers it has averaged $8.66 per overhaul." — *United Air Lines*

PERFORMANCE

Hydromatic Propellers have become stand- North America. How have they performed? airline operators . . . and reports these answers:

"During this entire period of operation we have found our requirements for replacement parts to be gratifyingly small, which, of course, directly results in reduced maintenance cost, both during overhaul periods and daily servicing operations."
— *Transcontinental & Western Air*

"Beyond very minor difficulties with laminated shim plates since replaced with solid plates and very slight wear on cam rollers no difficulties have been experienced with these propellers and no parts replacements have been made." — *Trans-Canada Air Lines*

"Our costs to date indicate they are less expensive to maintain than constant speeds of the same size. Consider them highly satisfactory." — *Northwest Airlines*

GENERAL COMMENTS.

"All in all, our experience with Hydromatics has been most satisfactory. We consider the propellers thoroughly 'service tested', and they have proved to be exceptionally reliable and consistent in their operation. We feel that they have very definitely contributed to the safety of air transportation without any appreciable increase in the complication or cost of operating. May we congratulate you upon the production of such a thoroughly satisfactory product." — *United Air Lines*

"The speed governing is substantially better than ever obtained with the constant speed propellers. For instance, on a ferry trip a few days ago it was necessary to readjust the propeller pitch but once or twice in a 1500-mile nonstop flight." — *Eastern Air Lines*

"I would like to emphasize the fact that these propellers have given us practically trouble-free operation." — *Trans-Canada Air Lines*

"You will probably be interested to know that since the installation of Hydromatic propellers on our DC-3 equipment our operating experience with them has been very satisfactory and flying personnel are particularly pleased with the accuracy of engine synchronism that is maintained on these installations."
— *Transcontinental & Western Air*

• • •

Here, then, are the reports . . . comprehensive, authoritative, conclusive. After a full year of rigorous service, a year in which these airlines have established amazing new operation records, unanimous tribute is paid to Hydromatic performance. Again Hamilton Standard, with the Hydromatic quick-feathering Propeller, plays a leading part in aeronautic progress.

HAMILTON STANDARD PROPELLERS

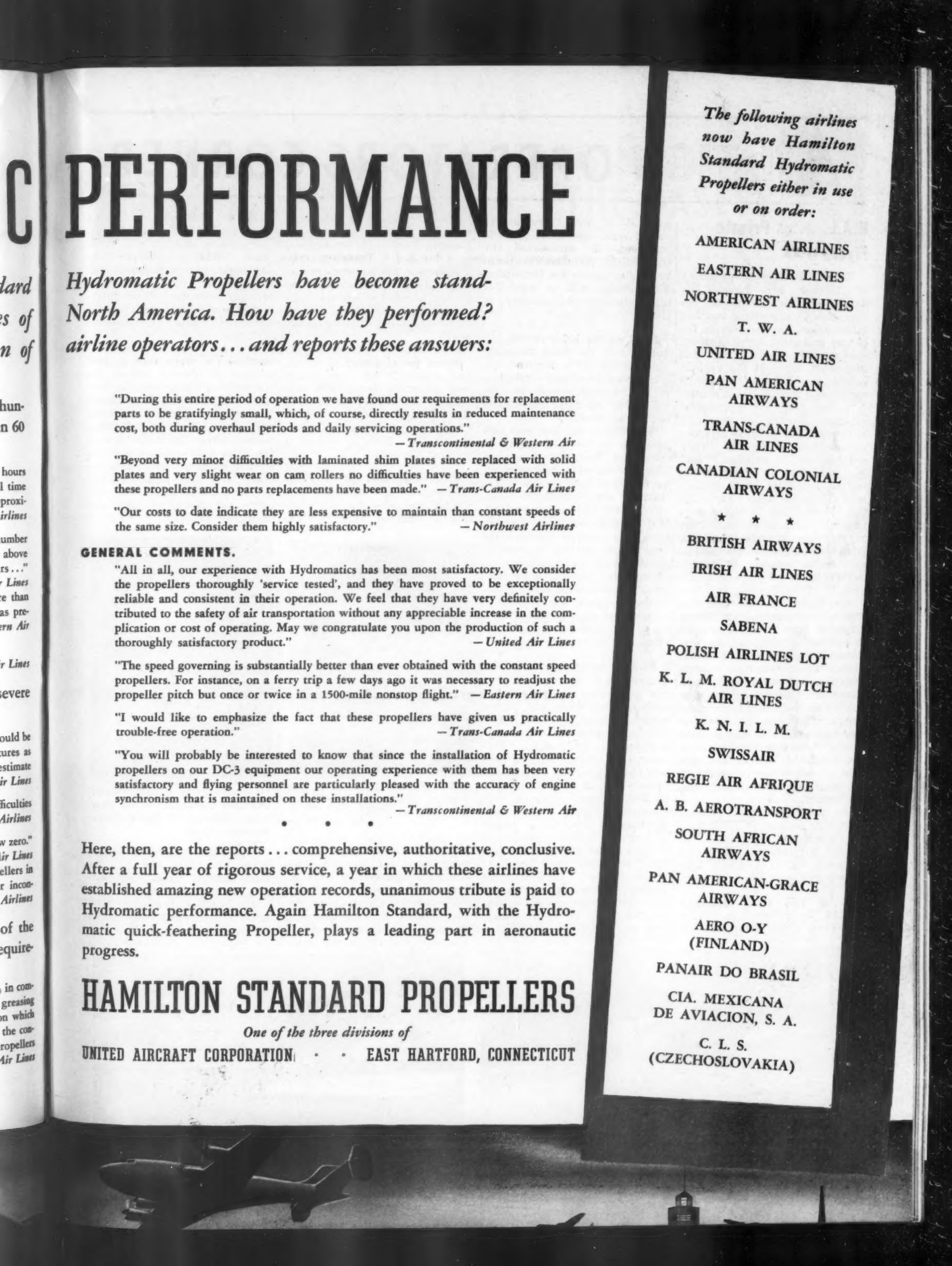
One of the three divisions of
UNITED AIRCRAFT CORPORATION · · EAST HARTFORD, CONNECTICUT

The following airlines now have Hamilton Standard Hydromatic Propellers either in use or on order:

AMERICAN AIRLINES
EASTERN AIR LINES
NORTHWEST AIRLINES
T. W. A.
UNITED AIR LINES
PAN AMERICAN AIRWAYS
TRANS-CANADA AIR LINES
CANADIAN COLONIAL AIRWAYS

* * *

BRITISH AIRWAYS
IRISH AIR LINES
AIR FRANCE
SABENA
POLISH AIRLINES LOT
K. L. M. ROYAL DUTCH AIR LINES
K. N. I. L. M.
SWISSAIR
REGIE AIR AFRIQUE
A. B. AEROTRANSPORT
SOUTH AFRICAN AIRWAYS
PAN AMERICAN-GRACE AIRWAYS
AERO O-Y (FINLAND)
PANAIR DO BRASIL
CIA. MEXICANA DE AVIACION, S. A.
C. L. S. (CZECHOSLOVAKIA)



AVIATION OPERATORS CORNER

U.A.L. Helps Private Flyers

W. A. Patterson, president of United Air Lines, has announced that complete cooperation in supplying weather information, hangar service facilities and other services wherever possible, would be extended to private fliers at the various points on United's transcontinental and Pacific Coast routes.

"I feel that the commercial aviation industry has not fully recognized the helpful role the private flier is playing in the development of aviation," said Mr. Patterson. "United, wishing to recognize that helpfulness and at the same time bring the private flier in closer contact with our operations so that he may better understand our methods and policies, invites the private flier to make such use of our facilities as may be available."

Mr. Patterson reported that operations personnel at United airports have been instructed to provide existing weather information compiled from United States Weather Bureau reports and from United's meteorologists and from reports by United ships in flight; to make hangar space available at reasonable rates at intermediate points where other facilities are not available, and to sell gas and oil when such service is not offered by an airport concessionaire.

He said also that private fliers are invited to have mail or telegrams addressed to United Airports or offices and to make use of United's telephones and other local facilities.

Sale of two more Grumman "G-21A" Amphibians to Asiatic Petroleum Corporation, making a total of five "Grummans" owned and operated by this company, is announced by the Gillies Aviation Corporation, sales agents for Grumman. These ships will be used for high altitude photography in Dutch New Guinea.

Hard on the heels of the bill authorizing the Civil Aeronautics Authority to conduct the civilian-pilot-training program is the announcement by the CAA that all flight instructors are to be rerated.

This step is the first in a new program to increase safety in the future training of student pilots. October 1 has been set as the dead-line for all flight instructors to familiarize themselves with the new standardized methods of flight instruction. The work of rerating the instructors will be started by the Authority's inspectors in all parts of the country about August 15, preference being given to those airmen who expect to be engaged in the Authority's vocational flight training program this next school year.

Aerial forest fire control in national forests of California will be carried on this summer with five airplanes just signed under contract by the Forest Service, according to an announcement by regional Forester S. B. Show. Three planes will operate for the 18 national forests from the Duck hangers at the Oakland Airport near where the Forest Service supply base at Government Island is located. Another plane will be located at Pomona and the fifth ship will be based at Fresno Airport. Largest of the planes is a tri-motored Stinson with 780 horsepower and a payload capacity of 1860 pounds. The two other planes working from Oakland are a four-place Stinson Reliant cabin plane powered with a 320 horsepower motor and a Travelaire cargo ship with a 330 horsepower motor. Both the Pomona and Fresno aerial fire control units are four-place Stinson Reliant cabin planes, 245 horsepower motor.

Races for airplanes of 50 hp. and under, 75 hp. and under, and unlimited horsepower will feature the show sponsored by the Pampa (Tex.) Junior Chamber of Commerce, September 23, 24. Bert A. Howell is general chairman.

Pilots may cool off by participating in the Muskoka Air Cruise scheduled for the weekend of August 12, 13. The Muskoka Lakes area is 100 miles north of Toronto, Canada and the schedule calls for arrival at Island Airport, Toronto, on the afternoon of Friday, August 11. On Saturday morning a mass flight will be made to Muskoka Airport where swimming, golf, tennis, and steamer cruises will be in order. After a barbeque Sunday night, the participants will prepare for the return flight Monday morning. Pilots interested should communicate with George M. Ross of Canadian Aviation.

Inactive for more than a year because of obsolete planes, the Air Service Division of the New York City Police Department has resumed operations using two new Wright 450-horsepower Stinson Reliants. One of the ships is a seaplane cruising at 155 miles an hour, and the other is a land plane cruising at 176 miles an hour. Both are police car-colored in green and white.

SHOWMAN: Franklin's Bob Fowler directs the free space air show at Syracuse.

IN FATHER'S FOOTSTEPS: Bernard DeWeese Jr. is now sales manager of the Chicago Aviation Corp.

The unit, originally established ten years ago, will resume activity from headquarters at the new city airport, North Beach. Carrying the most modern equipment, the planes are designed for immediate con-

RECONSTRUCTION: You wouldn't recognize Boulevard Airport since Dick Bircher rebuilt it after the fire a year ago.

NOT MIKE MURPHY: But Al Bennett doing the same sort of tricks with a Lenape Cub Seaplane at Hicksville, L. I.

"PULL OVER THERE": One of the two N. Y. Police Department Stinsons in hot pursuit of an evildoer.

version to ambulance uses in emergencies. Through their two-way police radio they can keep in touch with police headquarters and with radio patrol cars.

Inspector Arthur W. Wallender, who headed the original unit, will command the new agency. Six pilots and a ground crew of six men will do the operating.

PRESIDENT: C. Townsend Ludington who heads A.O.P.A.

EXECUTIVE CONSULTANT: Gil Rob Wilson is A.O.P.A.'s wise choice.

A.O.P.A. Gets Going

Aims and Sponsorship of New Organization Announced

Under the leadership of C. Townsend Ludington, president, and Gil Rob Wilson, executive consultant, the Aircraft Owners and Pilots Association is getting underway with offices in Philadelphia and Chicago. Aims of the new organization were outlined by President Ludington as follows:

"The Aircraft Owners and Pilots Association will work solely for the private pilot and aircraft owner. It will be the means of presenting his viewpoints and desires directly before the United States Government. The A.O.P.A intends to establish for the sportsman flyer those privileges which he deserves but which he has been unable to get because of lack of organization. We will furnish him with an alert and active medium which will see to it that his viewpoint is heard and respected. In addition, the A.O.P.A intends to inaugurate, on behalf of private flying in general, new research which will give the private flyer more safety with added economy and utility."

The list of Aircraft Owners and Pilots Association sponsors include: William Slater Allen, Brian Aherne, Lewin B. Barringer, Vincent Bendix, Harry Bruno, Gordon Brown, Ruth Chatterton, Henry Belin DuPont, Willette S. Foster, Corrington Gill, Fred H. Harris, Harold E. Hoffman, Jerome E. Lederer, W. Laurence LePage, Louis D. Lighton, C. Townsend Ludington, Nancy Love, Max. B. Miller, Col. Robert L. Montgomery, Marshall E. Reid, Mary G. Roebling, Igor I. Sikorsky, Rev. Father Schulte, Laurence P. Sharples (treasurer), Philip T. Sharples (vice-president), J. Story Smith, Col. A. H. Stockpole, Dr. Charles Allen Thomas, Chester H. Warrington, John M. Wells, Alfred L. Wolf (secretary), and James E. Yonge.

TAGGING THE BASES

with LES NEVILLE

An Orchid to Ken Behr

Our old friend Ken Behr must have read this column last month or maybe he read our minds. Anyway he did a swell job when he barged out and grounded Alex Loeb and Richard Decker who tried to take off from Floyd Bennett Field recently with an overloaded ship. Whether or not they were headed for Palestine (and no one seems to know) they had no business trying to take off with nearly 500 gallons of some sort of liquid in five gallon cans without official sanction of the proper authorities. We said last month that a great responsibility rested on the shoulders of airport managers because they had the final say on whether or not fellows could start on foolhardy flights. A particularly large share of this responsibility rests squarely on Ken's shoulders because his airport is particularly well suited to transatlantic attempts. So keep up the good work, Ken, and other managers of airports with long runways please profit by this example.

College boys by the thousands are to be turned into pilots under the provisions of the recent law authorizing funds for training 15,000 civilian flyers in the next year and 20,000 per year until the middle of 1944. It has taken a good many years to develop the present 20,000-odd pilots. It will be no cinch to turn out an almost equally large number in a single year. The C.A.A. is not totally unprepared. They have been working hard to lay the groundwork for this expected job. Already they have set about to re-rate instructors so that only the best will be available for this unprecedented job. But no matter how good an instructor may be, he is not at his best on an empty stomach. Operators must be allowed sufficient funds to enable them to pay their pilots a sufficient wage and to keep their equipment in the best possible condition. Even though there was but a single fatality among the 300 students trained in the experimental program, the percentage is too great. It would reach alarming proportions if extended to the full scale enterprise. The C.A.A. cannot afford any such record. And it can be avoided by exercising the greatest of care in selecting applicants, operators, and instructors and in making haste very slowly.

Police cars always worry us a little when driving in New York City. We must confess that the sinking sensation of discovering one unexpectedly came upon us when we saw the shiny new green and white Stinson's just bought for Mayor La Guardia the other day. But in spite of our personal feelings and of the criticism we have heard, we were glad to see a couple of airplanes put to this sort of work. The state of Pennsylvania (*Aviation*, Feb 1939) and others, have found airplanes useful in police work and there is no reason why these ships cannot give a good account of themselves in service. It remains for New York's Air Police to develop uses new for them and to get the most out of them.

$75 is too much for a pair of stockings. When even the movie queens stopped buying them at that price one manufacturer folded up and left a fine plant vacant. An enterprising school operator took it over at greatly reduced rental to accommodate a long waiting list of students. If you are running a school there may be an empty plant in your locality that would serve your purpose better than your present place and prepare you for the inevitable expansion in your business. Forget all about rental values and offer the owners about one-third of what you think it's worth. You may be surprised to see how eagerly they take you up on it.

STRUCTURAL RUGGEDNESS AND INTERIOR BEAUTY BY FAIRCHILD . . . EXTERIOR BEAUTY AND DURABILITY BY BERRY BROTHERS

BERRY BROTHERS
+ SKY-TESTED QUALITY +
BERRYLOID

Because they stand up better under the Sky-Test of sun, rain, hail, snow and ice, Berryloid Aircraft Finishes are used in finishing as well as refinishing 75% of all American-built and many foreign-built airplanes.

Write

BERRY BROTHERS
DETROIT, MICHIGAN
WALKERVILLE, ONTARIO

FAIRCHILD AIRCRAFT CORPORATION
ONE PARK LANE, HAGERSTOWN, MD.

July 5th, 1939

Mr. J. D. Greene
Advertising and Sales Promotion Mgr.
Berry Bros. Inc.
211 Leib Street
Detroit, Michigan

Dear Mr. Greene:

As manufacturers of what is recognized as one of America's most popular private-owner cabin planes...the Fairchild "24"...we are vitally interested in having the exterior finish of the airplane compare in beauty and durability with the high quality standards of the interior finish and structural ruggedness.

The "24", in addition to other advantages, features exceptionally low depreciation cost. The resale value of these planes is the highest on the market because they are built to give uninterrupted service and absolute dependability for many years of operation. Resale value, however, is to a great extent judged by the condition of the fabric and finish. Obviously, therefore, we are most careful in the selection and application of such an all-important item.

Our choice of Berry Bros. finishes...made after considerable experimentation...is a positive indication of what we think of the quality of your products.

Yours very truly,
FAIRCHILD AIRCRAFT CORPORATION

F. A. Galligan
Vice-President & General Manager

fag/lh

Safair, Inc., of Hangar "B", Roosevelt Field, Mineola, L. I., N. Y., operators of a U. S. Government approved school having the highest government rating have been designated distributors for the Piper Cub airplanes by Al Bennett, President of Bennett Air Service, and W. B. St. John, sales manager for the Piper Aircraft Corp., of Lockhaven, Pa. The territory covered by the distributorship includes Long Island and Metropolitan New York City, Mr. O. P. Herbert, president of Safair announced today.

Aeronca nearly doubled sales during the first six months of 1939. Domestic and foreign orders filled were 99.3 percent above those of the same period of last year. Decreasing of production costs are now passed on to the purchaser by substantially reduced prices. The new prices are:

"Scout" Model KC (Continental 40)	$1290.00
"Scout" Model CF (Franklin 40)	1445.00
"Chief" Model 50-F (Franklin 50)	1565.00
"Chief" Model 50-L (Lycoming 50)	1595.00
"Chief" Model 50-LA (Lycoming 50)	1635.00
"Chief" Model 50-C (Continental 50)	1695.00
"Chief" Model 65-C (Continental 65)	1795.00

REPORT CARD

Of Air School

The Welch Aviation School has recently been opened in connection with the Welch Aircraft Industries, South Bend, Indiana. The course of instruction is for 12 months and trains men in flying, airplane maintenance, construction, over-hauling and inspection as well as in traffic rules, navigation and mechanics. The school is equipped for 200 students and the graduates will be qualified to obtain their pilot's and aviation mechanic's licenses.

Ryan School of Aeronautics, San Diego, inaugurated primary flight instruction of U. S. Army Air Corps cadets on July 1st. Ground school is being given in the factory building formerly occupied by the Ryan Aeronautical Company, recently expanded into a new and larger plant. Flight instruction is largely given at two new airports developed in San Diego County some distance from the city of San Diego, though the cadets operate from Lindbergh Field, San Diego, and are housed in San Diego. Flight training is under the direction of Paul Wilcox and ground training by Walter K. Balch.

Purdue University was the winner of the United Air lines Safe Flying trophy, presented this year for the first time, at the Annual National Intercollegiate Flying Club meet held at Kenyon College, in Gambier, Ohio. Duke University came in second and the University of California was third.

The trophy is an annual award and will become the permanent possession of the club winning it for three successive years. Whenever the trophy may be won permanently, Mr. Patterson, president of United, announced that United would provide another trophy for the continuation of the award.

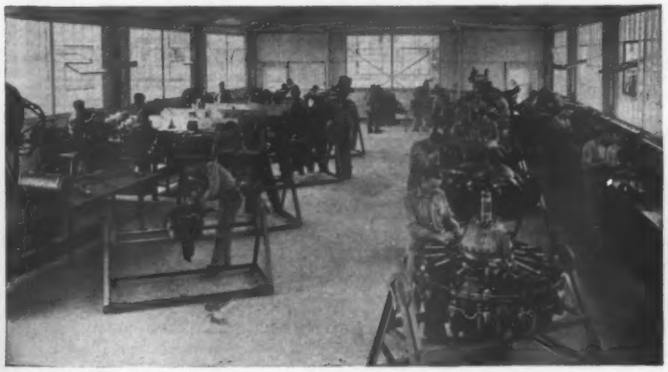
LUMBER PILE: This will build barracks for 300 mechanics training program students at Curtiss-Wright Tech.

CURTISS FLYERS: Charter members of the new school formed by workers at the C-W Buffalo plant.

Seventeen men have recently been graduated from the Rising Sun School of Aeronautics, eight having already received their A.&E. Licenses, while the others have taken the tests for theirs, according to a recent announcement by President Fred Vilsmeier. Eight of the graduates had to receive their diplomas via air mail as they had already been employed. The graduates are William Mueller, Francis Ginther, William Daminger, Michael Kaniuka, James Roberson, Horace Claypoole, John Gavula, John Schramm, Michael Mitek, John Miller, Joseph Babicki, John Burkholder, Harold White, William Sassaman, Clarence West, Robert Lehnen and Robert Vollrath.

To accommodate increased enrollments in its shop training courses, the Aero Industries Technical Institute has erected a fifth school building, 100 by 40 ft. in size, to house aircraft engine instruction work. Every type of engine now in use in the aviation industry is represented in the new engine laboratory building. To accommodate prospective aviation industry job holders Aero I. T. I. has placed its training program on a two-shift basis to match the present aircraft factory production schedules, and is having shop students punch time-clocks on 8–4 or 4–12 shifts. Other equipment in the school includes a complete machine shop, tests stands and benches, propeller shop, electrical shop, gas and electric welding shop.

With commercial enrollment at a new high, Curtiss-Wright Technical Institute, Glendale, Calif., began to carry water on both shoulders July 1st, with inauguration of the military flight and mechanic training programs recently contracted for by the Army Air Corps. Flight training is already under way, with prospective cadets quartered in the demised Aviation Country Club building, complete with swimming pool. Trainers are Stearmans and flying is mostly done from an auxiliary field some miles from Grand Central Air Terminal, with the would-be war birds returning to their Grand Central roost each evening. President Moseley expects enrollment approaching 6-700 students by mid-autumn.



ENGINES GALORE: In the new engine laboratory building of the Aero I.T.I.

CAA Flight Training Log As Of July 10

Name	Quota	Total Hours Logged to Date	Number of Students Soloed	Passed Tests
University of Alabama	30	1116¾	30	*30
Georgia School of Technology	30	809	30	15
Kansas University	20	788½	20	*20
Mass. Institute of Technology	20	747	20	9
University of Michigan	20	823½	20	18
University of Minnesota	20	750	20	9
New York University	30	904	30	12
North Carolina State College	20	780	20	18
Pomona Junior College	15	509¾	15	*14
Purdue University	50	1931¾	50	*50
San Jose State College	15	743	15	*15
North Texas Agri. College	30	1050	30	27
University of Washington	30	678	25	4
Totals	330	11,631	325	241

*Indicates course completed.

Vultee's Special Machines

(*Continued from page 31*)

stock of aluminum-alloy, or other alloys if desired. These sections may be U, V, L or hat shaped; however, other shapes or variations can also be formed. From these straight channels we roll rings of circular or oval section, or any variation. The machine is also used to roll rings from various extruded sections, or from duralumin tubing.

Another process of even wider application, and of great significance from a production standpoint, is our development of profiling machinery. This equipment helps solve the old problem of how best to cut out complex shapes from sheet stock. We also use the process to excellent advantage in profiling extruded sections to relieve flanges and make cut outs as required. There are two ways now in vogue in aircraft plants for doing profiling, and each has its advantages. One is to use a fixed cutter head mounted on a table, and move the work past the head by hand or mechanical means, using a suitable jig to guide the cutter head. This is the method which we have developed and now use in the Vultee shops. Another method provides for mounting the cutter on a system of swinging arms and moving it along the work, which is held stationary on the table. In either case a high-speed head, either air or electrically driven, is used. This tool is quite similar to the familiar wood router or shaper, except that special cutters are used and the machine must be reinforced for the work of cutting metal parts.

Profiling a Gun-Ring Mount

A good example of the application of profiling to a precision machine operation is that of taking the outside circle diameter cut on the extruded section gun-ring mount. This part comes to us as flat extruded stock of approximately I-beam cross section. We roll the flat stock into a segment of a circle and then mount it in a special fixture on the profiling table and pull the work past the cutting head by means of a hand-operated drum and cable. The result is a circle diameter cut held to within 0.002 in.

This part then goes on to the machine shop for milling and drilling operations which have been described previously. The same part, if machined in a lathe, would require an unusually large swing. Also, we cut lathe time, under the best of conditions, by at least 50 per cent. The machine used is adapted from a Union wood shaper with a 48-in. table top and a vertical spindle for the cutter, which rotates at 11,400 rpm. electrically driven. A 1-in. cutter head with two edges is used.

The Toggle Press at the North American plant. Its total working pressure is 6,000,000 lb. The total weight of the press and its foundation is 1,183,200 lb. Designed by North American Engineers it was built by Joshua Hendy Iron Works. **For further data see page 30**

A high-speed profiling table is used for finer work, the top of which measures 3 x 5 ft. and has an air-driven cutter head operating at speeds up to 22,000 r.p.m. One-piece tool heads with a diameter of ½ in. or even less, are used. This machine was designed and built in the Vultee plant.

The usual jig used for profiling is made of wood and Masonite, or metal and Masonite, the Masonite being cut to exact shape and bearing against a live or dead collar around the base of the cutter head, depending on the set-up. An example of this is found in the profiling of the heavy center-section spar caps, which consist of deep channel extrusions. The side flanges of this part are relieved deeply throughout much of the length of the cap, portions of the flange being left full depth at certain points to form gusset plates of appropriate shape for attachment of the truss members that are later assembled to the cap strips. This work is done with a steel and Masonite jig. The profiler is adapted from a Gallmeyer and Livingston wood shaper, with an auxiliary overhead arm to provide double bearing support for the tool spindle and to assure parallelism of the two edges, or flanges, which are shaped simultaneously.

In feeding the work through the machine, the Masonite guides at both top and bottom of the jig bear on top and bottom dead collars around the cutting tool, supported from an independent bracket bolted to the table top. After the heavy cuts have been taken with this set-up the work is shifted to a second jig and another cut is taken, using a small cutting head of ½ in. diameter, to cut narrow slots in portions of the beam flanges.

For light sheet-metal profiling work a "live" collar is usually used around the cutter head, bearing directly on the Masonite pattern edge of the profile block.

An interesting application of profiling is the long aluminum-alloy gusset plate used to help tie the wing rear beam to the trailing edge ribs and surface sheet material. This piece is approximately 18 ft. long and of saw-tooth shape varying in width from about 6 to 12 in. As the material is but 0.040 in. thick we had trouble with ordinary profile blocks due to the edges of the material distorting badly under action of the cutting tool. We have solved this problem and at the same time greatly increased the speed of the work through developing a special hardwood profile block about 18 ft. long, and using it in conjunction with an overhead cutting tool.

On the upper surface of the block we have mounted numerous locating pins, which fit into rivet holes predrilled in the unshaped gusset stock. In the bottom surface of this block are milled two slots extending the full length of the block. The slots exactly match the pattern of the two edges of the completed gusset plate. In operation these slots fit into a pin in the top of the profiling table. The work is then drawn past the tool, wiggling as it goes to conform with the bottom slots. By drawing it once past the tool in one slot, and once in the other, the gusset plate is profiled accurately on both edges and is then ready for final assembly into the wing structure. In production it is possible to stack these sheets into layers as many as 15 deep and profile them all at once, which is a major item of labor saving, and further assures rigidity of the edges under action of the tool.

CHICAGO AND SOUTHERN AIR LINES, INC.

GENERAL OFFICES
LAMBERT – ST. LOUIS MUNICIPAL AIRPORT
ROBERTSON, MISSOURI

This is what we mean by DEPENDABLE PERFORMANCE!

Airplane Division
Aeronautics Department
Goodyear Tire & Rubber Co., Inc.
Akron, Ohio

Gentlemen:

The ease and remarkable ground handling facilities of the Model 10 Lockheed Electra is due largely to the Goodyear Airwheels and the brakes used on this type of passenger transport.

During the past four years Chicago and Southern has completed 27,639 takeoffs and landings with only two mechanical delays due to brake trouble and not a single failure of an Airwheel tire.

We take this opportunity to congratulate Goodyear for their engineering and development of this tire, wheel, and brake which has established this marvelous record of performance for Chicago and Southern Air Lines, Inc.

Very truly yours,
CHICAGO & SOUTHERN AIR LINES, INC.
R. L. Anderson
R. L. Anderson
Superintendent of Maintenance

We think you'll agree that 27,639 take-offs and landings with only two brake delays and no tire trouble is proof of superior performance. That's why more and more commercial, private and military ships are being equipped with Goodyear airplane tires, wheels and hydraulic brakes—*they insure greater safety!* For information write: Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California.

Safe underwheel—with big super-soft Goodyear Airwheels and sure, smooth-acting hydraulic brakes.

Airwheel—T. M. The Goodyear Tire & Rubber Company

On your new ship Specify—

THE GREATEST NAME IN RUBBER

GOODYEAR

AIRPLANE TIRES, WHEELS and HYDRAULIC BRAKES

WACO THE WORLD OVER . .

● Waco Model "C" Cabins are among the 184 Wacos in regular training, mail and passenger service in Brazil.

● Waco "Military" models are in regular service in Uruguay, Venezuela, Nicaragua, Cuba and other countries.

● Waco "Freighters" carry passengers, gold ore and machinery to and from camps in the Canadian wilds.

● Many Waco Cabins with freight interior or ambulance equipment are in charter service in Alaska.

● A Waco "Tricycle" is owned by the British Air Ministry.

● A Waco "Tricycle" is owned by Sir Donald Field, Chief Minister, Jodhpur State, Jodhpur, India.

● Several Wacos are owned by African Flying Service (PTY), Ltd., Johannesburg, South Africa.

● A Waco "Tricycle" is used for blind landing experiments by the Civil Aeronautics Authority, U.S.A.

● 14 Wacos are used on the Tata Air Lines covering the western portions of India.

● And hundreds of other Wacos are in all types of service in thirty-five nations.

● You'll find Waco airplanes in daily service all over the world. Waco popularity tells its own story. Waco builds dependable airplanes—with *all the performance that's claimed for them!* Waco owners will vouch for that.

The MODEL "C" Waco is roomy—luxuriously appointed—fast in flight—slow and thoroughly control-conscious in landing.

The MODEL "N" embodies the same smart appointments—plus a tricycle landing gear. It's the easiest ship of its size to *learn* to fly—the *safest to fly!*

The MODEL "S" is the lowest priced—the most efficient and economical five-place ship on the market.

See your local distributor, or write for catalogs

EASY TO BUY WACO AIRPLANES EASY TO FLY

WACO MODEL "S"—New tapered NACA cowl . . . New super-visibility rounded windshield.

WACO MODEL "C"—Fast, luxuriously appointed, comfortable for five persons with luggage.

THE WACO AIRCRAFT COMPANY, TROY, OHIO

Wright Researchers

(*Continued from page 21*)

frame about the point X to change the angle of attack, in which case the angle indicated by the pointer P was added (subtracted when the angle was negative) to the angle of attack. We had a large scale of degrees, not shown in the photograph, on the floor of the tunnel on which the instrument was mounted.

It will be observed that the surface S, being mounted on a parallelogram, will maintain the same angle of attack at all positions of the arms HH; that the drag of the aerofoil, being balanced directly against the lift of the same aerofoil, knowledge of the exact wind velocity is not required; that so long as the axles A, A are kept in a vertical position the weight of the surface S needs no counter-balancing; that the position of the centre of pressure on the aerofoil S does not affect the readings, since the pressures always act on a radius equal to the length of the arms H.

The force measuring arrangements may at first appear complicated, but to those acquainted with the modern techniques of wind tunnel research a number of outstanding features will immediately become apparent. The question of translating the recorded measurements into forces effective on a full-scale machine is the crux of the whole situation, and in this respect the Wright brothers revealed not only considerable understanding of mechanics, but an astonishing appreciation of the pitfalls involved in small scale wind tunnel testing.

Orville Wright has given me a verbal description of the whole process, which unfortunately I must reproduce in my own words. The lift, as noted before, was balanced directly against a set of resistance plates which had previously been calibrated against the drag of a square flat plate of known area in the same position in the air stream as the wings to be investigated. The drift was measured in per cent of the lift. Thus far the steps taken were mainly to obviate difficulties resulting from non-uniform and non-constant velocity in the air stream, although care had previously been taken to reduce these to a minimum. Still, however, no direct measurement of actual forces to be expected on the full-size wings was available. This was accomplished by the use of a glider tested in 1902. This glider had a wing scaled up from one of the models tested in the wind tunnel and by means of glide tests in winds of known velocity it was possible to determine the lift and drag as actual forces. These tests in effect calibrated one of the wings tested in the wind tunnel for full-scale conditions, and since the relation of the other wings to this wing was known from the wind tunnel measurements, the characteristics to be expected from all the wings when flown full size were directly indicated by the tunnel data.

This description from Orville Wright reveals, I believe, one aspect of the Wright brothers' research work that has never been realised before—the fact that they adopted an expedient in the year 1901 that automatically corrected measurements at small Reynolds number to the Reynolds number encountered in flight. By the steps described they reduced the critical assumptions to one: that the order of merit of the aerofoils would not be seriously affected by Reynolds number, though the absolute values of the coefficients might change. It was not until about thirty years later that aerodynamic research settled this question and showed that at least for a number of critical aerodynamic characteristics the assumption was valid.

One other point of interest in this connection deserves note. Using the average flight measurements on their 1902 glider and the wind tunnel results on models; the Wright brothers calculated that the unit drag of a square flat plate of large area was equal to the square of the speed in miles per hour multiplied by the coefficient 0.0033. At the time, Orville Wright has told me, they had their choice among figures varying from 0.0025 to 0.0055, based on the tables of other investigators. Much subsequent research has led to general adoption of the figure 0.00328 for the coefficient in question; truly astonishing agreement with the value reached by the Wright brothers through averaging a series of results obtained in flight measurements on a glider in the year 1902.

The results of the investigations on the aspect ratio (6) wings of various cambers are shown in Fig. 5. These were reproduced directly from the original plots made in December of 1901. The first item of interest is the scales employed, which show the lift in per cent. of the resistance of a square flat plate and the drift of the wing in per cent. of its lift. The shape of the curves is sufficiently familiar to all concerned with aerodynamics that they need no further identification. Models 7, 8 and 9, it will be noted, show the effects of camber with which we have later become familiar in more detail. In present non-dimensional terms the drag coefficient of a square flat plate is approximately 1¼, so the figure shows that the maximum lift coefficients obtained with the circular arc aerofoils varied from about 1.3 to about 1.5, values clearly in agreement with our modern knowledge of aerofoils. With this information it is amply evident that the Wright brothers, through their investigations in 1901, gained a clear physical conception of the behaviour of wings on which to base the design of their successful "flying machine." Their subsequent rapid progress to the goal of sustained flight and the technical and scientific achievements that have followed I need not recount.

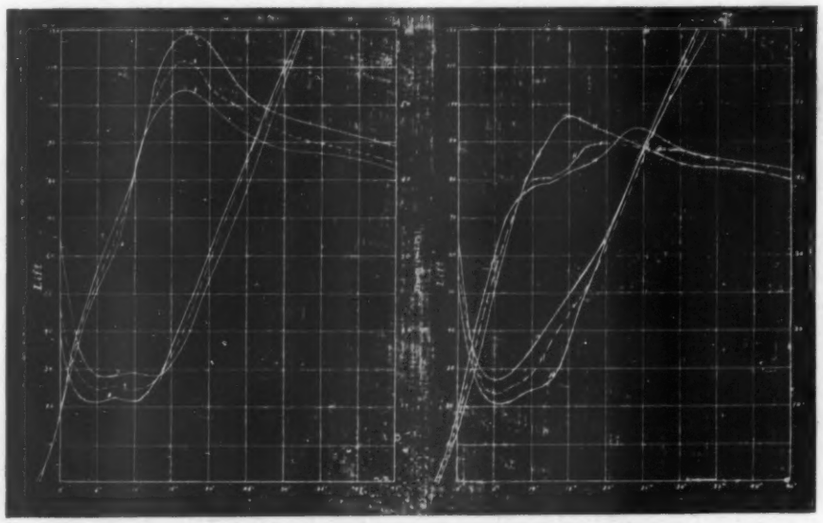


Fig. 5. Reproduction from original plots of data (1901)

Simplifying Stress Analysis

(*Continued from page 47*)

The resultant of this flow is obviously equal to S and acts in the plane of the web.

Now if we replace the vertical web by a curved one, as in Fig. 3 (b), the shear flow is given by the same formula, but in this case the resultant S acts at a distance x to the left of the original position. Therefore we must apply the shear load S at this point if we do not want to twist the beam. The distance x is easily determined by the formula

$$x = 2(A/h) \quad \ldots\ldots\ldots\ldots (2)$$

which means that x is twice the average "height" of the enclosed area (A) between the shear web and the line joining the two flanges. The proof of this formula is very simple and can easily be shown by taking moments about any point.

The second important formula for shear flow is that commonly referred to as the "membrane analogy," or by various other names. Perhaps it would be helpful to assign a more definitive name such as "torque-flow," which will be used in this paper. The torque-flow formula is:

$$q = \frac{T}{2A} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where T is the torque and A the area of the section enclosed by the shell or skin. This picture is shown by Fig. 3 (c), representing a cross-section through a shell carrying the torque T. The resisting shear flow will be substantially constant if the ends of the box or tube are free to warp.

The third useful formula for shear flow is a more general form of the well-known formula for "horizontal" shear stress. If we assume that axial stresses due to bending agree with the classical beam theory ($f = My/I$), the shear flow at any point on the shear web is given by the formula:

$$q = \frac{SQ}{I} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

where S is the shear load,

Q is the "static moment" of the area (as defined in any text book),

I is the moment of inertia of the section.

Equation (4), incidentally, yields the simpler equation (1) whenever the flange material is assumed to be concentrated so as to take all the axial loads due to bending.

Box Beam Analysis

A very helpful simplification in the stress analysis of single-cell beams was pointed out by R. S. Hatcher in his Letter to the Editor, in the July, 1938 issue of the *Journal of the Aeronautical Sciences*. It is often assumed that we need to find an "elastic axis" such that the application of shear loads along this axis will not twist the beam. While this is true for a multi-cell beam, it is entirely unnecessary for the single cell. The simplified procedure can be visualized by thinking of the beam as two separate structures, as shown in Fig. 4 (b) and (c). If the beam is cut at any point it becomes possible to determine the shear flow due to direct shear by eq. 4, assuming that the beam theory applies. This condition is illustrated by Fig. 4 (b). The location of the resultant shear, R, can be determined by taking moments of the shear flow loads about any convenient point. This can be done by dividing the periphery of the shell into small sections (which may be assumed to be straight, with little error), or by a graphical method such as suggested by Sibert in the February, 1938, issue of the Journal of the Aeronautical Sciences. Now if we assume that the *cut* shell has no torsional rigidity (which is practically true), it will be unable to carry a vertical shear load unless the load is applied so as to coincide with the resultant of the shear flow (indicated by the distance x in Fig. 4 (b)). If the actual shear load S is applied at some other point, such as indicated by the distance d, it will be necessary to resist a torque equal to Sd. This torque can be resisted by the *uncut* shell, as indicated in Fig. 4 (c), and the resulting shear flow is readily determined by the torque-flow formula (eq. 3). To get the final result, it is only necessary to add, algebraically, the shear flow due to direct shear (in the *cut* shell) to the flow due to torque (in the *uncut* shell).

As pointed out by Hatcher, this method of solution appears to solve a statically indeterminate problem without recourse to least-work or strain-energy methods. Actually, the only part of the problem that is statically indeterminate is the distribution of axial loads due to bending and this is taken care of by the usual beam formula. Even when the classical beam theory is modified by some assumptions to cover the effects of "shear lag," the problem of shear flow remains statically determinate and can be solved by the foregoing methods, provided that the axial stresses due to bending are known or can be assumed.

A final simplification of single-cell analysis methods can be effected by combining the load-axis method with the above method of "cutting" the cell. Instead of determining the location of the *resultant* of the shear flow in the "cut" beam it is only necessary to obtain the *moment* of this flow about the load-axis. This torque may then be added to the actual torque about the load-axis before applying the torque-flow formula. This process completely eliminates any necessity for the determination of an "elastic" axis or a shear axis. In actual analysis the computations can be carried out most conveniently by working with unit loads, such as 1000 lbs. for shear load. This permits much of the analysis work to be done independently of the determination of the loads for different design conditions.

Unfortunately there seems to be no immediate prospect of simplifying the multi-cell beam analysis to a statically determinate form. However, many of the above principles can still be applied, as the problem is essentially the same except for some additional computations based on the principles of strain-energy or consistent deformations. A careful study of the case in question will often show that some simplifying relationships exist, by which the problem can be reduced to statically-determinate form with little error. In view of the large number of conditions and members that must be investigated for a modern large airplane structure, it is very important, from a standpoint of cost and time, that analysis methods be kept as simple as possible. Refinements in stress analysis procedure should not get too far out of step with the other factors that influence the strength of the airplane.